CLEAN AIR ACT OVERSIGHT
(Field Hearings)

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BEFORE THE
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ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE
NINETY-SEVENTH CONGRESS

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CLEAN AIR ACT OVERSIGHT

SATURDAY, JUNE 27, 1981

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
Seattle, Wash.

The committee met at 9:30 a.m., in the auditorium, Federal Building, 915 Second Avenue, Seattle, Wash., Hon. Slade Gorton presiding.

Present: Senators Gorton and Murkowski.

Also present: Representative Joel Pritchard.

OPENING STATEMENT OF HON. SLADE GORTON, U.S. SENATOR FROM THE STATE OF WASHINGTON

Senator GORTON. I would like to call this meeting to order. We have many people to hear today, and we have a distinguished visitor with us only for a relatively short period of time.

I wish to start promptly. This is the fourth in a series of hearings held outside of Washington on the pending reauthorization of the Clean Air Act.

Earlier hearings have been held in Maine, in Montana, and in Wyoming. Further field hearings will be conducted in Alaska, by my good friend and colleague, Senator Murkowski, who will be here until 11 this morning; and in Vermont and New York.

In addition to this series of seven field hearings, the Senate Committee on Environment and Public Works has conducted numerous hearings in Washington itself. All of this is to enable the committee to determine whether the Clean Air Act requires amendment and if so, how and in what areas. This law is exceedingly complex, second perhaps only to the Internal Revenue Code in that respect. Like the Internal Revenue Code, it touches on the lives of every American to one degree or another.

It influences the quality of our lives, the operations of our businesses, and the health of our citizens. It is because of the law's pervasiveness and importance that the Committee on Environment and Public Works has conducted a substantial number of its oversight hearings in areas outside of Washington, D.C. These field hearings provide an opportunity to examine the act from State, local, and regional perspectives, and provide an opportunity for people who would otherwise not be able to travel to Washington, D.C. to contribute to the process.

A recent news story published here stated that I appear to favor major changes in key sections of the Clean Air Act. In fact, I have not committed to any amendment to the act and will make no decisions on the amendments until our committee hearings are over and the Reagan administration has published its proposals.

The first of our sessions today will deal with prevention of significant deterioration and the protection of visibility. During that session, we will hear from Federal and State agencies, local businesses, and public interest groups. In the day's second session, we will examine the problems associated with those areas in Washington which fail to meet the health protective standards of the Clean Air Act.

In the third and final session, we hope to hear from those private citizens who wish to come forward. Those who wish to testify later are asked to sign up at the table just outside the auditorium. Witnesses will be called in the order in which they have signed up.

Since we do have a full day ahead, we will proceed with the first set of witnesses right after my colleage, Senator Murkowski, says a few words.

OPENING STATEMENT OF HON. FRANK H. MURKOWSKI, U.S. SENATOR FROM THE STATE OF ALASKA

Senator **Murkowski**. Thank you very much. I certainly welcome the opportunity to participate with my colleague from the State of Washington, Senator Gorton.

As you know, there is no other State in the Union which has a closer kinship to the State of Washington than my own State, Alaska. We share in many mutual economic matters and have concerns and certainly interests in common.

I have been told by my long-tenured colleagues in the U.S. Senate—and this has been substantiated by Senator Gorton—that the Clean Air Act is really an extremely complex piece of legislation. The committee has been working on reviewing the act in attempts to reauthorize a law which all segments of our community can support.

I am pleased to participate in a hearing in my own State that will be held on Thursday. Unfortunately, Senator Gorton can't be with us, but I hope that we will have another opportunity later this summer to attract you to Alaska, Senator.

In any event, the material garnered at these hearings will supplement and become an official part of the legislative history. The information that we will gather today from the diversified list of witnesses will better help members of the Senate committee to become more familiar and have a greater understanding of the status of the Clean Air Act. While I am a new member of this active committee, I have been participating in the extensive testimony, and I am confident that we have, both Senator Gorton and I, become convinced that we must preserve the fundamental building blocks of the Clean Air Act; however, the desire to protect the public law has resulted in numerous Federal, State, and local laws, and we, again, are faced with a situation that has become so complex and so technical that we have got to relate to that.

In 1977, when the Clean Air Act was being amended, Congress appears, at least in the eyes of some, to have shown a lack of trust in the States or the ability of the Administrator of the Environmental Protection Agency to implement the various provisions of the act.

With a sense of trying to protect the public and preserve the environment, the law was drafted to include procedures and technical standards that would have normally been left to the discretion of an Administrator of a Federal agency.

I certainly do not question the wisdom of the distinguished Members of Congress that drafted that legislation, however, I am convinced that perhaps the staffs played a major role in putting together the situation we have today which is the extreme complexity, and that perhaps legislative intent wasn't meant to be quite so complex.

I remain committed to maintaining the comprehensive methods by which the Clean Air Act protects the air that we breathe, but I am interested in learning whether there are ways of preserving the national health quality standards and protecting the public health while making the Clean Air Act more concise, more clear, and less duplicative of the regulatory process.

I am looking forward to hearing from the witnesses today, Senator, and I would like to say to the group on either side of the spectrum of the issue that it will do the committee little good to hear rhetoric. Polarization on this issue will serve certainly no one's issue. We look forward to hearing constructive and thoughtful testimony, if there are intelligent suggestions that will assist the Committee on Environment and Public Works in reauthorizing the Clean Air Act to make the act more efficient in protecting our environment for ourselves and our children.

Again, I thank you, Senator Gorton, for helping me to make this possible as a committee consideration of this act. I certainly look forward to working with you and other members of the committee.

Again, I apologize for having to leave at 11:10, but I have to be in Boise, Idaho this afternoon. With that, I will conclude my opening remarks.

Senator GORTON. Thank you. These are two other brief preliminaries: We hope this afternoon to have with us Congressman Pritchard on his return from Washington, D.C.; and second, because we have many witnesses who are formally a part of the program and a significant number of others who do wish to speak, we will ask the witnesses to limit their comments to 10 minutes.

If a witness testimony cannot be encompassed in that time, we ask them to summarize it, so that everyone will be heard and so that we will have an opportunity to ask questions.

Our first witness, quite appropriately, is the mayor of the city of Seattle, Charles Royer. Perhaps you will welcome us home, Charlie. In any event, we welcome you to this hearing. We look forward to hearing what you have to say.

STATEMENT OF HON. CHARLES ROYER, MAYOR, SEATTLE, WASH.

Mayor ROYER. Thank you, Senator, very much. We do welcome you back to Seattle. Sometimes I think we are always more pleased when both the legislature and our delegation are back home.

Senator GORTON. I am sure you are.

Mayor ROYER. I know you feel the same way when you get a chance, as I know you do, to take advantage of our environment early every morning.

I am Mayor Charles Royer of Seattle, Mr. Chairman, Senator Murkowski, and I welcome the opportunity to speak with you here in Seattle. It seems as if things are happening so quickly in Washington, D.C., and without the kind of deliberation here at home that we like to have. It is delightful to have you come out on this piece of legislation and discuss it right here in our backyard. We sincerely do appreciate that extra effort.

I know that it is difficult to get around this big country and to discuss these issues with our people, but we all appreciate your help.

I will try to summarize those parts of my testimony which I can, although there are several specifics which I would like to, for purposes of accuracy, stay with my prepared text on.

I think any look forward of the very complex Clean Air Act needs to begin with a very brief summary of, at least in the opinion of the city, why it became so complex and why it turned out as it did.

Back in 1970, when basically the substance of this act was written, it was recognized that air pollution did not respect State and local or even international boundaries, which is of concern in our State; that inconsistent regulations among States would almost certainly create havens of pollution, almost as often union or right-to-work havens are created, driving industry out of other areas, causing locational decisions for some reason other than basic economics.

For the automobile, which is the major contributor to pollution all around the country, in our city, there was a choice between national emission standards at the factory and many different sets of standards to be set by the various States.

So air pollution was recognized back in 1970, I think appropriately so, as a national problem. Having done that, the very next step is to sort out the Federal, State, and local responsibilities for solving that national problem. The ambient air quality standards to be set by the Federal Government and State and local governments were given some latitude. Perhaps there could be more, but they were given some latitude in devising plans to meet those national standards.

The Clean Air Act was modified but not substantially changed by the 1977 amendments, but it has been in place for 11 years now. I think that is long enough for us to evaluate, without rhetoric and without confrontation or polarization, the effects of those changes and of the basic act itself.

So I don't want to convey the impression to you today that we are dealing with a perfect piece of legislation. The act is cumbersome, and as you have described, it is terribly complex, especially in the process of establishing implementation plans. But those problems, many of them can be solved by streamlining, not by forsaking the basic structure of the legislation.

One reason regulations affecting local governments become complex is because it is a complex environment, in my opinion. We are dealing with different cities and in vastly different standards. Complexity is perhaps a reflection of the real world, rather than an enemy to be attacked for its sake alone. I think the intergovernmental cooperation which has occurred in the Puget Sound region—which you will hear more about from our PSAPCA representatives today—is a good model for solving this kind of national problem.

I think the Puget Sound region also gives the committee a pretty good model to look at in how the Clean Air Act can work and how it must work.

I think our relationships among the various local and Federal and State officials are pretty good, and I think we have, in many ways, used the act well.

I want to take issue with three of the recommendations made by the National Commission on Air Quality which tried to undertake the very difficult task of reviewing and commenting on the act. There are many of the findings which we agree with. There are several which the Puget Sound Air Pollution Control Authority will get into in more detail, but I would like to highlight just three for you.

Those are the recommendations dealing with the new car emission standards; inspection and maintenance standards and the need for deadlines and sanctions.

We were all disappointed, I think, to see that the National Commission recommended relaxation of some new car emission standards. That is clearly a Federal responsibility. Once the pollutants leave the tail pipe, it is impossible for local government to regulate them away. Unless the Federal Government holds firm on stringent new car standards, cities like Seattle will be stuck with trying to meet Federal clean air standards and deadlines with one arm figuratively tied behind our backs.

Most new cars already meet tail pipe standards that the commission proposes to relax. There is no more effective means, in our opinion, of controlling air pollution than limiting emissions at the factory. Even if relaxing those standards means a slight drop in the cost of the car, that economy, if you will, needs to be measured in terms of cost-effectiveness in the long term, not just in the short term, in an economy that is bizarre to say the least.

The economic health of the automobile industry need not be held inconsistent with the physical health of human beings. So we believe that the new car standards should not be rolled back.

The commission also recommended that the inspection and maintenance of auto pollution control devices be required only in larger cities like Seattle. And that Federal sanctions be relaxed.

Inspection and maintenance programs, we believe, serve the same very important purpose as the new car standards, that is, control at the source. It keeps boiling down to, really, one fairly simple statement: The best way to stay clean is to avoid dirt. So I have argued that setting tough factory standards still needs to be a Federal responsibility.

I argue now that upholding those standards for the cars actually driving around our streets and highways must still be a federally mandated local responsibility and that should not be relaxed.

We have a job which we are required to do locally, which we want to do, and which the law gives us the proper tools to do. So we believe the law should not take away or blunt those tools.

As you know, even clean Seattle is plagued with all-too-free violations of the Federal Government monoxide standard and just not a regulation that we are concerned about. The mayor's office receives calls occasionally from people who say, "What is going on? What is happening during one of those difficult pollution periods in the city?"

We received, until 1987, an extension to meet that Federal standard, provided that we establish an inspection and maintenance program, so we took on the responsibility, recognizing full well the costs and burdens, and got from the legislature the enabling authority to conduct inspection and maintenance programs, which brings me to the third point.

Our coalition was held together here in part because of the threat of Federal sanctions, the threat on highway and sewer construction funds. It appears to me that the threat of sanctions serves an important purpose and often arms local government officials with the necessary political support, and constituents work to be able to do some of these tough things. So I think they have served an important purpose.

So have legislative deadlines for attainment of standards. The National Commission's recommendation is to eliminate deadlines and substitute attainment reviews every 3 years. Now, Seattle, and other jurisdictions took those deadlines in the act very seriously, both because the deadlines were in the law and because attaining standards as soon as possible made sense to us.

Elimination of the deadlines would be a breach of faith with those cities and States which made a conscientious effort to meet the deadlines, and it would reward those who delayed, hoping for some kind of legislative relief.

Statutory deadlines have been an important part of the Clean Air Act, and they should not be abandoned except under very specific circumstances.

One of those circumstances might be the deadline to meet the urban particulate standards. That might be one such exception under which deadlines night be relaxed.

Let me just say that on the other two issues, very briefly in conclusion, that is of importance to the city of Seattle, and that goes to aesthetic considerations and it goes to the visibility regulations of which this committee will address.

One of the major industries, if not the major, often certain times of the year, is tourism. There are 26,000 square dancers in our town today. They are bringing a new brightness and life to our city, but that is tourism. They are bringing jobs and income to our city.

It would be a shame if those visitors went to Paradise Valley or Hurricane Ridge, or went to a place where they can see Mount St. Helens—which everybody wants to do—and found themselves unable to see the mountain.

We support the concept of reasonable visibility protection in national parks and other scenic areas of our country.

A related issue protects areas that have clean air. Seattle is considering the investment in a very large coal plant to be built in an area which now does meet air quality standards.

We have no desire to export our problem to that area of our State. We believe requirements for prevention of deterioration should remain in the Clean Air Act. We are not just saying that, but we are also conditioning our participation in the coal plant with cleanup investment, knowing it will increase the cost of the power that we receive, but knowing that it is important to our State.

I believe there is political support for our kind of action. There is no question that clean air, just like everything else, costs a lot of money. As our economic situation gets tighter, we know that there is temptation to reduce that cost of cleanup.

I believe there are some very false economies there. If you have been to China where they are trying to put in new industry at an amazing pace, in Japan, in China, they are thinking about, "How do we control this dirt that the investment, the new investment, will create?" I was surprised, talking with local officials in China, that one of the primary concerns of theirs was the technology of making investments, new plant investment concurrently with the state of the art in pollution control equipment.

The country is not the cleanest country in the world. They recognize that new investment going in very quickly, new plants, will have a dramatic effect on their already difficult lifestyle. So they are thinking about that cost-effective investment for the future, which was very impressive to me.

We keep hearing, in everything that is happening to the system of Federal support and to the regulatory process, that there is going to be a major realinement of Federal responsibility in the country, a major change in the system of providing resources back to cities and States; that regulation is overburdensome and too complex; and that dramatic changes need to be made. Here—perhaps this is different from the rest of the country—but here, what is guiding us in our assessment of those changes coming out of Washington, is: One, a recognition that there is too much haste, I think, and there needs to be more deliberation like this, not just with the mayor, but with the people who do the work, who have the staff and the ability and the knowledge of the ability that we are talking about.

I know you will spend that kind of time. But second to haste and the pace at which some of these major investments are being changed, national investments of time and national purpose, that States can do all of this themselves.

States can, but the national purpose representing the Clean Air Act, the national goal, the recognition that national control, national participation is preeminent—because it is a national problem—that recognition needs to be treated very, very carefully as you go about modifying the act, in my opinion.

There is a lot of changes that can be made about the way States and local governments participate with the Federal Government, but national purpose, often recognizing there are no boundaries in problems, is one problem that I know you and your colleagues in the Senate will treat carefully.

Thank you.

Senator GORTON. Your last comment leads me to a question which I would like to put to you, Mayor Royer: You are active on the Regional Air Pollution Control Authority here. What is your perception of the relationship between the Federal agency, and State and local efforts at the present time; and what, if any, changes would you propose in those relationships, either as to the setting of some or all standards under the act, or as to the actual administration and enforcement of the act?

Mayor **Royer**. I always liked the notion of regionalization of some of the Federal responsibility. I think we have worked very well with the regional office of EPA, but their ability to react with local and State governments is less than full.

They don't have the flexibility, perhaps, that maybe at the regional level they ought to have to work directly with local officials.

I can give you one quick example which relates not to clean air, but it is an indication of the kind of relationship that exists in the cleanup of a major storage facility for toxic materials, for dangerous materials. We were working it out with the regional office through the fire department and everybody else who had on-the-street experience with this facility. Suddenly, the Justice Department and the Federal EPA, someone we had never spoken with who had never talked with us, had decided that going through the courts would be a better means of dealing with the problem for us, that meant closing the facility down, a very damaging situation for the rest of the region, transporting this material further than it needed to be transported; causing people to dump the stuff in the stream rather than take it to the damaged facility.

It was a bad situation that a stronger regional operation of EPA, with more flexibility to deal with local governments, could have dealt with.

That is an implementation concern that I have. Once it comes to the setting of standards, when it comes to the recognition of certain national problems, that, of course, required a Federal role and it is a Federal responsibility, but in the implementation, in dealing with complexity by just sitting down and looking at the facts of a regional problem, we need a stronger regional role on the part of EPA, in my opinion.

Senator **Murkowski**. Mayor, in regard to your expansion of the application of regional control, much of the testimony that we hear back in Washington is based on the generalization that the effort for applying the act uniformly is not practical because conditions are different in Denver than they are in Seattle, for example.

Do I understand you correctly that you would feel more comfortable in working within, a national scope of control with the dictate and the flexibility under a regional application rather than a uniform national application?

You are just one step away from the State having control then.

Mayor **Royer**. Yes. I would do anything to get two steps away from having the State have control.

We are very nervous about dealing just with the State, and this is not to say that the State is not trying to do a good job, but the State is not equipped to take on this kind of responsibility. If it is a philosophic decision that says States create the Federal Government and therefore States ought to therefore be dominant in any relationship, that is one thing.

But if we are talking practicality and what about really works, it seems to me that another President, who was a Republican who believed in some local control, President Nixon, set up and got moving, the regionalization of the Federal Government, which I thought was a major contribution that he made.

It was based on the same set of philosophic principles. Get local government decisionmaking closer to the people; get government decisionmaking closer to the people, but do not advocate Federal responsibilities; do not get the Federal Government out from under——

Senator GORTON. You are concerned with the regionalization of the Federal approach. Is it that the region doesn't have enough power to make decisions and to acclimate them to a particular regional situation?

Mayor Royer. Yes.

Senator MURKOWSKI. I think you would agree that the application of the Clean Air act as proposed under the Nixon administration and what actually evolved out of the system is, far and away, something that would be debated as to just what was anticipated when they put it together. I think what we have to relate to, and of course, what we are hoping to do, is—I think it is the commitment of the committee—is a genuine concern to maintain what we all want, and that is the health and clean air of the Nation, but it is how you get there from here.

I can appreciate your concern as the mayor of this grand city your reluctance to have everything on a State control, but by the same token, the frustrations that exist in Washington, and those that have expressed that the application of the Federal uniformity is just not workable, leaves us with this dilemma that hopefully, by the end of this year, we will have some possible alternatives that hopefully you will feel somewhat comfortable with.

Senator GORTON. Thank you very much, Mayor. We appreciate your testimony.

The next witness representing the State is John Spencer, deputy director of the Washington State Department of Ecology.

STATEMENT OF JOHN SPENCER, DEPUTY DIRECTOR, WASHINGTON STATE DEPARTMENT OF ECOLOGY, ON BEHALF OF GOV. JOHN SPELLMAN

Mr. SPENCER. Good morning, Senator Gorton, Senator Murkowski. My name is John Spencer, and I am the deputy director of the Washington State Department of Ecology. It is a pleasure to be here today to present testimony on behalf of Governor Spellman. We sincerely appreciate the effort you have made to this hearing to Seattle, providing an opportunity for agencies and citizens to express their viewpoints on legislation affecting air quality.

The Federal Clean Air Act, and specifically, the 1977 amendments, is an example of far-sighted legislation that embodies worthy goals and a national commitment to the health and welfare of our citizens. As with most comprehensive legislation, experience in implementation reveals problems that deserve correction to make the law more effective.

I feel that continuation of strong national legislation is necessary, and I would like to address some mid-course corrections that may help achieve the delicate balance between the environmental and economic goals of the State.

Current legislation provides a dominant role for the Environmental Protection Agency and includes rigid national requirements and time schedules that do not recognize the problems and priorities of individual States. We recommend that greater flexibility be given to the States to establish programs needed for their area.

Better use of available resources provided by all levels of government could be achieved through a clear definition of responsibilities and a reduction in Federal oversight. We recommend defining the activities to be handled directly by the Federal Government and those that would be the primary responsibilities of the States.

The Federal effort should concentrate on areas assigned to them and reduce costly and ineffective oversight.

This would provide more workers and fewer reviewers. Examples of activities that can best be accomplished by the Federal Government include: Research; training; vehicle emission requirements; standardization of monitor siting; calibration of equipment, and development of new source performance standards; setting of primary quality standards and provision of technical assistance.

A closely related problem is the State implementation planning process. The requirement for a planning document is excellent and should be retained, however, the myriad of detail that is required for an acceptable plan has decreased the effectiveness of the concept. Too much effort is spent to achieve an approved plan, regardless of the applicability of some requirements.

The State implementation plan should identify problems, priorities and solutions; it should be a State plan for achievement, not one that is used for national consistency and enforcement by Federal agencies.

Under the current system, a change in law by a State legislature or in regulations by a State agency has no effect until it is approved as a change in the implementation plan by EPA.

As a result, a Federal agency has the basic authority to preempt the directives of a State legislative body. EPA should adopt regulations of national significance and enforce those regulations if States fail to do so. If necessary, EPA should also have the authority to enforce State and local regulations but not to dictate the content of those regulations.

This recommendation would also prevent EPA from publishing guidelines which, without public hearing, become requirements on the State for adoption of regulations solely to achieve an approved implementation plan.

Primary quality standards, which by definition are necessary to protect public health, should be retained as a national requirement. However, the standards and associated criteria on which they are based should be subject to a totally independent scientific review. This review should provide the credibility necessary to justify the costly programs that may be required to meet the standards.

Continued Federal grants to air pollution control agencies is necessary; loss of this support could not be made up from State and local budgets due to the increasing social and economic impacts being experienced.

This does not imply a lack of commitment on the part of State or local government to the air pollution problem. I believe their interest and support will continue, but the programs would suffer if Federal grants are decreased.

Visibility is a primary subject of this hearing. It will be addressed in more detail later by a representative of the Department of Ecology. We are cognizant of the value of the scenic vistas which we are richly imbued with. A program to protect this resource is desirable. Actions, however, must be designed for each area and implemented over a reasonable span of time so that resources are not diverted from the more important job of meeting health standards.

We must avoid costly mistakes and economic disruptions that could result from hasty decisions to meet arbitrary schedules.

Prevention of significant deterioration is also of concern. There are areas in the country, and certainly in the State of Washington, that may not be adequately protected by current air quality standards. However, the PSD program goes beyond what is necessary and dilutes the effort to protect pristine areas.

By definition, primary and secondary air quality standards will protect public health with an adequate margin of safety and public welfare. Current class 2 areas should not be penalized because they are, as yet, undeveloped.

The PSD program sets a tertiary standard which is dependent on existing air quality and which has no basis related to effects. There is no justification for the increment selected and no criteria documents written to delineate the purpose of the program.

It has all the appearance of an arbitrary action.

We recommend that all reference to class 2 and class 3 areas be removed from the PSD provisions of the law. Current class 1 areas should be retained but no new class 1 areas established except by action of the States. States have the authority, and should assume the responsibility, for determining other areas that are not adequately protected by current standards, and to restrict current air quality standards as appropriate.

Nonattainment is another issue. It is apparent that the requirements of the present law are not achievable within the time frame that was established. We should not retreat from the mandate to achieve health-related primary standards. However, adjustments are necessary so that the goals are realistic rather than idealistic.

The total suspended particulate program is an example of an ill-defined and unworkable requirement. Expensive and effective controls on traditional air pollution sources have significantly reduced particulate emissions. However, there has not been a comparable improvement in air quality nor have these actions been adequate to attain current air quality standards.

Before we continue to twist the screws down on these traditional sources, I think we need to look toward the other sources that are contributing to these problems, which are not now adequately controlled.

Arbitrary differences have been established between small and large communities based upon undocumented assumptions about the toxicity of reintrained dust that may occur in those areas. There has been no accommodation for natural dust storms that prevail throughout many parts of the West.

In addition, EPA is currently proposing a new standard which is oriented to particle size. Should this change occur, it may significantly affect the definition of nonattainment areas, the relative importance of various source categories, and the selection of control strategies necessary to achieve the standard.

There are additional control actions that can be taken now which would be of benefit to communities under any circumstances. State and local government should pursue these options. However, we should not be required to pave roads and parking lots, require second generation control on traditional sources and otherwise impose additional expensive programs on our cities and industries until the need becomes clear.

We recommend that particulate attainment requirements be placed into a new time frame which provides for the development of particle size standards and monitoring techniques. Existing controls should be retained in the interim.

In addition, it is essential that all time schedules for attainment have sufficient flexibility so that progress becomes the basic requirement. The feasibility of meeting standards varies by pollutant and by area of the country. Reasonable control strategies necessary to meet those standards also vary. Federal law should accommodate those differences.

Let me depart here for a moment, from the testimony, to note that in the Clean Water Act, the goals that have been set, the dates that have been set have not been attainable in many cases. This has been a tremendous bureaucracy of paperwork in order to comply or seemingly comply with those schedules which, in fact, the schedule has not been met.

Vehicle emission inspection is a controversial areas that is being reconsidered by Congress. The State of Washington is starting a vehicle inspection program in the Seattle area in January 1982. Inspection costs to the public over a 5-year period will exceed $35 million.

Washington accepts that, the need for vehicle emission inspections.

The program was authorized by the Legislature because the Clean Air Act includes massive sanctions for failure to comply. We have already canceled the program in Clark County because it was found to be unnecessary. However, we are also faced with buying out the contract that was signed for implementing the program in that area.

Should Congress change the requirements, we would urge that they recognize the impact that has already been imposed on the States and assume the financial obligation that may result from amendments to the legislation.

The final item I would like to address is the subject of jurisdiction on Indian reservations. Many tribes have expressed an increased interest in both environmental preservation and industrial development. Federal law is not clear on the responsibility and authority for air resource management on tribal lands. A State implementation plan cannot be an effective management document if the regulations contained therein are not applicable on a statewide basis. We urge Congress to address the issue and provide the needed clarification.

We believe that the goals of both the members of tribal organizations and the citizens of our State are the same; that is, to achieve a clean and healthy environment to live in. It has become ineffective because of the lack of its clarity.

Let me close by saying, Senators, that we appreciate the opportunity to express our concerns and offer any assistance we may provide to you. Thank you very much.

Senator GORTON. Mr. Spencer, the Clean Air Act provides the State with the option of administering the prevention of significant deterioration program itself or leaving it to the Federal Government. The State of Washington has chosen to allow the Federal Government to operate that PSD program.

Can you tell me why there should be a change to make it easier to administer by the State, or is the State just simply uninterested in it?

Mr. SPENCER. The State is not uninterested in it. I think this goes also to the question that was asked to Mayor Royer, too, about the State to Federal to local relationships. Our answer to that is basically that the law is so difficult and complex that for the State to take on these kinds of responsibilities, the flexibility we might have is, in essence, meaningless.

So it becomes a matter of having the resources——

Senator GORTON. You don't find it cost-effective to take over, then, is what you are saying?

Mr. SPENCER. Yes; we think we need the flexibility needed to take it over. If there is no flexibility, there is no sense in taking it over.

Senator GORTON. Mayor Royer related to some testimony from the PSAPCA, which has a number of areas of specific agreement and specific disagreement with the recommendations of the National Commission on Air Quality. Does the State have a position on that Commission report which is, of course, a document central to our reconsideration of the act? Do you have specific areas of agreement or of disagreement, or has the State and your department not examined it closely?

Mr. SPENCER. We have examined it. We have prepared testimony in the past or assessments of it in the past. I am not prepared to go into the details of it today, but there are areas in it that we do disagree with it.

Senator GORTON. I would appreciate receiving the State's comments.

Mr. SPENCER. We would be glad to provide those comments, Senator.

Senator MURKOWSKI. You made a statement with regard to the responsibility for air quality resource on tribal lands. We have a common concern in Alaska. I am wondering what has triggered this, other than, obviously, there is resource development potential or in actuality, do you feel that the Federal Government, then, should come up with a clear definitive opinion on just what responsibility is associated with the native occupancy of the traditional tribal lands?

Is that so you can get away from this gray area you are in now?

Mr. SPENCER. Yes. Our concern transcends just the air controllability. We have also had problems with the Air Pollution Control Act and Federal construction. But, for example, the Federal Government EPA provided quantities to the Caldwell Indian Reservation to conduct an air quality plan. They have also provided funds for the water quality planning. We have no idea, at this time, as to what the final procedures will be to approve those plans and to the extent that those plans will become controlled on the reservations and, as a matter of fact, those plans not only control the lands on the reservations, but in the case of air quality, they will have an effect on the major development outside the reservations.

This is an area that is completely without definition.

Senator GORTON. Do you simply want a definition without caring what is in the definition or do you have some ideas?

Mr. SPENCER. Our definition is have the ability to carry out the enforcement of the State-established standards and those standards should apply on Indian reservations.

Senator MURKOWSKI. So State standards should be it?

Mr. SPENCER. That is right. There should be an opportunity and a way for the tribal organizations to participate in that and, if possible, if the State is willing to allow the tribal organizations to have enforcement authority, that the State can participate in providing that authority to them, just as we do in our State with local authorities.

Senator GORTON. Thank you very much.

The first panel this morning will be Jim Tobin; accompanied by Shirley Clark, Donald P. Dubois, and Darrell Weaver. We will proceed in that order.

STATEMENTS OF JIM TOBIN, REGIONAL DIRECTOR, NATIONAL PARK SERVICE; SHIRLEY M. CLARK, CHIEF, DIVISION OF COMPLIANCE AND AIR QUALITY, NATIONAL PARK SERVICE; DONALD P. DUBOIS, REGIONAL ADMINISTRATOR, ENVIRONMENTAL PROTECTION AGENCY; AND DARRELL WEAVER, PROJECT DIRECTOR, VISIBILITY AND STATE IMPLEMENTATION PLAN ACTIVITIES, WASHINGTON STATE DEPARTMENT OF ECOLOGY

Senator GORTON. Mr. Tobin and Ms. Clark represent the National Park Service, and this is the first of two panels on visibility.

Mr. TOBIN. Thank you, Mr. Chairman.

We are pleased to have the opportunity to testify before the Senate Committee on Environment and Public Works field hearings that are being held here in Seattle. You have asked that we provide certain information concerning the protection of visibility in the Pacific Northwest under the authority of the Clean Air Act which is to be reauthorized this year.

The information that we will provide today was developed from an analysis prepared by the staff of the National Park Service and made a part of the record for rulemakings that we will describe in a minute. This information does not necessarily reflect policies of the Department of the Interior concerning various aspects of air pollution control.

These policies are being developed in conjunction with the administration's position on the Clean Air Act legislation. For this reason, and because portions of the existing visibility program are being litigated or are involved in an ongoing rulemaking, our testimony today can only describe the activities of the National Park Service that are already on the record.

Here is a little background. In December 1980, the Environmental Protection Agency promulgated regulations to protect and enhance visibility in certain national parks and wilderness areas designated as mandatory class I areas under the prevention of significant deterioration provision of the 1977 amendments to the Clean Air Act. The affected class I areas include those determined by Environmental Protection Agency in an earlier rulemaking to have important visibility values. This regulation is currently under review by Environmental Protection Agency and it may be revised.

The Environmental Protection Agency's December 1980 regulations allow Federal land managers, including the Department of the Interior, to designate integral vistas, areas of visibility extending from points within class I areas to points outside class I areas—for protection by the States. On January 15, 1981, the National Park Service (NPS) proposed criteria to identify integral vistas, and proposed 177 such vistas including 10 vistas from 5 mandatory class I areas in the Northwest region.

The comment period of this proposal closed in February but it was reopened on April 24, 1981, for 45 days, and the proposed action was changed from the status of proposed guidelines to proposed regulations.

The comment period for the proposed rulemaking ended on June 8, 1981, and the Department of the Interior is now in the process of reviewing the comments that have been received. In addition, the Interior Department management is currently reviewing the scope of ongoing visibility activities within the context of the existing Clean Air Act.

THE NATIONAL PARK SERVICE CRITERIA FOR IDENTIFYING INTEGRAL VISTAS

The identification of the proposed integral vistas is based on a National Park Service analysis of whether the park vistas meet either of two identification criteria. These criteria are: One. Whether the vista is important to the purposes for which the area was created; and

Two. Whether the vista significantly contributes to visitor enjoyment of the area.

For each mandatory class I park a narrative description with information and data to support the vista's selection as an integral vista is provided. Each proposed vista is identified by the name of the observation point, the view angle, and the key features of importance within that scene.

In the Pacific Northwest region of the National Park Service, there are five mandatory class I areas which were evaluated for integral vistas. These are: Olympic National Park, North Cascades National Park, Mount Ranier National Park, Craters of the Moon National Monument, and Crater Lake National Park.

The largest of these areas is Olympic National Park, which is located on the Olympic Peninsula about 60 miles west of town. Visits to the park number between 2.5 to 3 million per year.

That is sort of a summary of it, Mr. Chairman.

Now, with your permission, I would like to have Ms. Clark of our Division of Air Quality give you the process we have followed in the identification of integral vistas.

STATEMENT OF SHIRLEY M. CLARK

Ms. **Clark**. To explain the process, we shall briefly outline the steps in vista evaluation for Olympic National Park. The National Park Service has on file written materials which provide more detail on each identified vista.

PRINCIPAL CONTENT OF VISTA

The vista selected from Olympic National Park, Deer Park, like other vistas in this region, was judged to be primarily of scenic importance in contrast to cultural or scientific—other categories used by the National Park Service.

I have photographs of the integral vista from Olympic. If I can get some assistance here—looking across the Strait of Juan DeFuca is Vancouver Island, with the city of Victoria, Port Angeles in this area, the town of Squim, with Dungeness Spit. This is Mount Baker, Scenic Cross of Puget Sound, up Port Puget Sound, which is approximately 90 miles from Olympic National Park, and this is Glacier Peak, which is approximately 100 miles from Olympic National Park.

Senator **Murkowski**. What is the elevation where the picture was taken?

Ms. **Clark**. 6,000 feet.

Legislative history for the establishment of Olympic National Park includes several references to scenic values. A 1936 letter from the Secretary of the Interior to the chairman of the House Committee on Public Lands noted the importance of protection of the high scenic value of the area. Although the vista from Deer Park is not specifically mentioned in the legislative history, it was one of the few high elevation areas in the Olympics accessible by automobile at the time the park was established, and the view was well known.

SIGNIFICANCE OF VISTA

Freeman Tilden, in his book, "The National Parks: What They Mean to You and Me" (1950), reports:

> Deer Park, in the northeastern section, can be reached by a road that climbs to 6,000 feet and affords splendid views of the mountain cluster, the Juan de Fuca Strait, and Vancouver Island."

From back country use permits and an economic study made of the park, we know that the vista is frequented by both local visitors and those traveling long distances.

Rowland Tabor, in his book "Guide to the Geology of Olympic National Park" (1975), noted that this viewpoint was a place to gain an understanding of the geologic story, both inside and outside the park:

> Few viewpoints in the Olympics better allow the imagination to recreate the time of the Ice Age than does Blue Mountain. To the north, look out over the plains and waterways to see where the southern margin of the great Cordilleran ice sheet lay about 15,000 years ago.

Deer Park is remote and not particularly easy for the average visitor to reach. Facilities there are primitive: the roads are rough, steep, and dusty; there is no electricity, no flush toilets; and no interpretive programs are presented. And yet about 10,000 visitors annually make the trip to see the view from Deer Park.

Portions of the integral vista from Deer Park are viewed from other observation points in the park. Two of these, Lookout Rock and Hurricane Ridge, receive a visitation of over 500,000 in some years. At both sites, the view is important to the visitor experience. At Lookout Rock parking for 18 vehicles is provided in a pullout loop separated from the main road.

Interpretive exhibits entitled "International View" and "Ice Age Glacier" illustrate the view to points outside the part, history, and science.

At Hurricane Ridge, interpretive signs point out items of scientific and scenic interest. Benches are provided. The 130-yard walk from the main parking areas is a paved, smooth trail. Other paved trails lead from the viewpoint to other nearby viewpoints. During the summer, naturalists lead frequent walks that include this viewpoint. On winter weekends, naturalists conduct snowshoe hikes past this point.

Mount Rainier National Park, which is located on the western slope of the Cascade Range, about 65 miles southeast of Seattle, has a visitation approaching 2 million per year. Integral vistas from this area include much of the Cascade Range. Views are panoramic and, with ideal visibility, one can see into Canada, to the Cascade Crest, the North Cascades, Puget Sound, and the Olympic Mountains.

I have some photographs from one of the integral vistas from Mount Rainier. This is not the whole integral vista, but just a few I would like to point out, if I can see upside down. This is Mount Baker, a distance of 160 miles from Mount Rainier National Park; Glacier Peak, 120 miles from Mount Rainier National Park; down the Cascade Range to the Alpine Lakes Wilderness Area, which is approximately 80 miles from Mount Rainier National Park.

This observation site in Mount Rainier is Tolme Lookout.

Senator MURKOWSKI. What is the elevation on that?

Ms. CLARK. That is also approximately 6,000 feet.

We are cooperating with the States of Oregon and Washington in making a determination of existing visibility in Crater Lake, Mount Rainier, North Cascades, and Olympic National Parks. Our cooperative efforts will provide use of monitoring instruments in three parks and visual observations in all four this summer.

There has been no identification of specific sources causing impairment of sibility in any mandatory class I area administered by the National Park Service in the Pacific Northwest Region.

IMPACT OF INTEGRAL VISTAS ON DEVELOPMENT IN THE NORTHWEST

It is virtually impossible to assess the impact of integral vistas on future development in the Northwest until such projects have been proposed and analyzed by the appropriate state authorities and Federal land managers.

The observation points in most of the national parks in the Northwest are elevated, not at sea level. These parks are mountainous, and many observation points are located on elevated terrain. The integral vista recommended for Olympic, for example, as

I pointed out before, is from an observation site at 6,000 feet in elevation.

Many of the key features viewed from observation points in the Pacific Northwest are also elevated. In a given case, this factor may limit the impact that any source located at lower elevations may have on visibility impairment of such integral vistas. For example, plumes from existing or new sources may occur at lower elevations without affecting the integrity of the visitor's view to the important key features of the scene.

This concludes our statement. We would be happy to answer any questions you may have.

Senator GORTON. I think rather than go through the panel, we will ask questions now, since Senator Murkowski has to leave soon. I gather from a note that I have received, Ms. Clark, that you were personally involved in many of these vista determinations here in the State; is that correct?

Ms. CLARK. The documents were prepared in the park. They were sent to the regional office where I screened them and looked them over and decided whether they were adequate vistas or not.

Senator GORTON. This is essentially a question for both of you. I gather that the function of the National Park Service in this respect is simply to determine where one of these viewpoints is and the nature of the obstructed view from it. It is not up to you to determine what must be done to preserve the view, to make any kind of cost/benefit analysis considerations in connection with cost control strategies?

Mr. TOBIN. You are essentially correct, Senator. We do have a chance to comment upon any proposed actions that would impair the visibility and to make our thoughts known to the State regulatory commission at this time.

Senator GORTON. You will not be the direct regulatory agency?

Mr. TOBIN. We are not a direct regulatory agency in this regard.

Ms. CLARK. However, the National Park Service is preparing a regulatory impact analysis because the notification of it or identification of integral vistas is a proposed rulemaking.

That report is just being finished up, and it was supposed to be finished yesterday. It will be available next week, if you would like a copy.

Senator GORTON. Thank you.

Frank?

Senator MURKOWSKI. Ms. Clark, you indicated that there had been no identification of specific sources causing impairment of visibility in any of your class I areas administered by the Park Service?

Ms. CLARK. That is correct, in this region.

Senator MURKOWSKI. In this region.

You have actually made the attempt to make that determination that there are no identifiable specific sources causing impairment?

Ms. CLARK. That is correct.

Senator MURKOWSKI. You are satisfied?

Ms. CLARK. In cooperation with the staff of each park.

Senator MURKOWSKI. Have you had an opportunity to comment on any proposals that would, in your opinion, cause impairment of visibility? In other words, some type of an industrial expansion?

You indicated that you had the opportunity and would be required to make your comments known. You have not had an opportunity, then, to comment negatively on a problem?

Ms. CLARK. Not negatively.

Senator MURKOWSKI. And you have examined a number of projects?

Ms. CLARK. Two.

Senator MURKOWSKI. What were those two, for my curiosity?

Ms. CLARK. One was the northern tier project.

Senator MURKOWSKI. The pipeline?

Ms. CLARK. Yes, the port facility in Port Angeles.

The other was a generation station—a steam generation station that was going to be converted from oil to coal, located near Craters of the Moon National Monument.

Senator MURKOWSKI. When these proposals are made, what process do you go through to establish what the visibility might really become as a consequence of the development? Do you use models? Do you use engineering techniques?

Ms. CLARK. I personally rely upon the technical people that the National Park Service has. I know that they do use models.

Senator MURKOWSKI. Thank you.

Senator GORTON. One other question: I understand that the theoretical maximum distance which can be seen in the Earth's atmosphere may be upward of 300 miles. In many places in the area in which Senator Murkowski and I have spent our last 6 months, it is normally no more than 10 or 20 miles. In the last week, it was much less than that from time to time.

Do you have any idea how far one can see in the natural atmosphere here in the State of Washington, say, from the altitude at which you took those pictures?

Ms. CLARK. I know that the picture from Tolme Lookout—in that picture, you can see Mount Baker, which is 160 miles, but that is——

Senator GORTON. Can you see any mountains in British Columbia?

Ms. CLARK. The quality of the photograph limits how far you can see, particularly on the blowup.

In the smaller prints, you can see something. Whether those are mountains or not, I would rather not speculate.

Senator GORTON. In any event, these vistas, the impact of this element of the act is much greater in the West, is it not? There are more of these national vistas. The sight distances are greater?

Mr. TOBY. I would express the personal view that generally in the West the vistas have greater distance and greater clarity than the Northeast, probably because the air is cleaner there more often.

Senator GORTON. Together with the fact that there is more high points from which to take them?

Mr. TOBY. Yes.

Senator GORTON. We will go on to Mr. Dubois.

You are from the Regional Office of EPA?

STATEMENT OF DON DUBOIS

Mr. DUBOIS. Mr. Chairman, Senator Murkowski, my name is Don Dubois. I am the Regional Administrator of the Pacific Northeast-Alaska Region of EPA. I am responsible for administering EPA programs in the States of Washington, Oregon, Idaho, and Alaska. I do appreciate this opportunity to present to you region X's perspective on two aspects of the Clean Air Act, one being the prevention of significant deterioration. If I may use the initials PSD, it will save us all a bit of time.

The second point I would like to discuss briefly would be the visibility protection program. These, of course, are elements of the existing Clean Air Act program to protect clean air in areas where air quality is already better than the national ambient air quality standards would otherwise require.

Speaking first about prevention of significant deterioration, the PSD program, I think, could be characterized as a rather complicated patchwork of legislative rules, Federal rules, and judicial opinions. In 1974, the very first PSD program was administratively instituted by EPA as a result of a lawsuit won by the Sierra Club which forced the agency to address the so-called clean air areas.

In 1977, the Clean Air Act was amended and established a legislative basis for the PSD program and further expanded that program to include all major new sources of air pollution and modifications to existing major facilities. Federal rules to implement the PSD provisions were promulgated by EPA in June of 1978.

In 1979, the Washington, D. C. Court of Appeals handed down a major opinion entitled *Alabama Power* vs. *Costle,* addressing key aspects of how EPA was implementing the PSD program.

The evolution of current PSD regulations has resulted in a changing and complex set of requirements for EPA to administer and for industry to neet.

The Clean Air Act established a 3-tiered classification system in clean areas and placed limits on the increase of pollution allowed for each of the three classes of areas. These are usually referred to as increments of air quality.

The smallest amount of pollution is allowed in class I areas, which include all national parks and wilderness areas above a certain size. Moderate amounts of pollution are permitted in class I areas—generally enough to accommodate some industrial growth. The greatest amount of pollution is permitted in class III areas.

Under the act, all areas which are not established as mandatory class I areas are designated class II areas. The States have the authority to reclassify these areas, either into class I or class III. To date, none of the States have taken any such reclassification in our region here in the Northwest and Alaska.

The EPA Regional Office administers the PSD program in this region. No States in region X have yet received delegation of the program. We expect that two States, Alaska and Oregon, will have approvable PSD programs and will be administering the program in the near future. The State of Washington is deferring the decision on adopting the State PSD regulations until after considerations of the Clean Air Act amendments are completed.

Idaho's plans, at present, are indefinite because the State legislature is completely eliminating funding for the State air program. I think this reluctance of the States to accept delegation of the program is, in my opinion, directly related to the complexity of the program and the frequent changes in program requirements that have occurred.

I think John Spencer somewhat verified that as far as the State of Washington.

Frequently, a course proposing a construction must obtain both State and Federal permits and in some cases may be subject to both PSD and the nonattainment provisions of the statues.

The current process for obtaining a PSD permit normally entails the following steps: Corporations planning a project come in and meet with the EPA staff to discuss and learn about the requirements of the program.

Monitoring stations are installed if none exist and from 4 months to 1 year's worth of air quality data are obtained. Air pollution control equipment is evaluated by the company to search out the best available control technology.

The PSD application is then prepared by the company and then submitted to EPA. EPA often or usually requires clarifying information prior to determining that the application is complete. Once the application is complete, EPA processes and approves the application.

Let me touch briefly on our experience in implementing this program. During the past 3 years, we have processed 18 applications for permits for new facilities in Washington State. The processing time varied from 2 to 11 months with an average of 6.3 months. This is the average time which elapsed from the receipt of a complete application to the permit issuance date.

In order to get a complete understanding of the time requirements for the PSD process, one must also take into account the time necessary for the corporation to do the studies and do the monitoring, and so on, that I have described earlier in order to develop the complete application.

Senator GORTON. If we add that to the 8.3 months, do you have any idea of the average time it takes the corporation to engage in those studies and work out its application?

Mr. DUBOIS. I have some examples. I believe we are in the process of preparing a more complete report that will come to your committee.

It's rather highly variable. Oftentimes the companies will come in very early before they have even come to a good idea of what kind of a project they want or even just exactly where they want it, to begin to learn about our requirements. So that the other thing I think that is important is that this present application work can go in parallel with other project planning activities that the company has to engage in anyway, and other permitting.

So it is a little bit hard to answer your question with great precision, but it would be often a matter of several months of preparation of application before it came to EPA.

Senator GORTON. You may proceed.

Mr. DUBOIS. Most of our experience in this region has been with medium to larger corporations. These companies are best able to perform preapplicant PSD activities in tandem with other corporate planning activities necessary to site the facility. We are unaware in region X of any of the smaller corporations which have been deterred by this total PSD processing requirement, but it certainly is possible that some of them could have been.

Conversations with project managers during the course of the review process have shown that PSD regulations definitely influenced siting decisions for some projects. These were company decisions made before an application was received by EPA. Once in the process, EPA review of some project applications resulted in control equipment changes or configuration changes, but not in project relocation.

Senator GORTON. I would like to stop you again there. Obviously your part in this is informal, but what kind of influence would PSD regulations have on siting decisions? Would they have to do with size? Would they have to do with whether or not they would go at all, or would they literally move them a considerable distance from one place to another?

Mr. DUBOIS. I think probably the most likely would be the location. In other words, if the company were making a siting decision about a facility that would emit pollutants, one of the things they would take into account was, obviously, whether it was close to a class I area, with very much constrained limits.

I think they would have to take into account, in some fashion at least, the dispersion ability of the atmosphere in that particular area; in other words, whether it is in a deep, mountainous valley that might trap pollutants might suggest a decision to locate in a better ventilated area; those kinds of things.

Senator GORTON. In summary, would it have a tendency to centralize industrial concerns in areas in which there were already a number of such concerns, as opposed to dispersing them through a large region?

Mr. DUBOIS. In centralizing, they would be locating in or near enough to areas where the standards are not being obtained. Then they must go through another procedure to obtain offsets to allow room for them to come in.

So I would say it would certainly tend to cause industry to stay further away from class I areas, national parks, and that kind of thing, but by and large, I don't think it has caused any desirable trend that I have seen to move to the big cities, away from the rural areas that are not classified as class I.

There is one final note on PSD. Our experience shows that the control technology requirements is usually the controlling factor in setting emission limitations. In only 1 of the 18 cases in Washington State did the increment or the constraints of the class I or II or III area end up dictating the final emission limits for the facility. This would, of course, suggest area of possible simplification in the PSD permitting process.

Turning now quickly to the visibility protection program, you have already heard a rather detailed description of it, but I will just run through my testimony very quickly.

Congress, of course, has established many parks of various kinds. The Clean Air Act, as it was amended in 1977, directed EPA to explore the relationship between manmade pollution and visibility impairment around parks and wilderness areas and established a national visibility goal.

The goal specified that existing pollution is to be remedied and future pollution which would interfere with visibility in these areas is to be prevented.

In 1979, November, EPA published a report to Congress called "Protecting Visibility," which discusses in detail the present scientific knowledge of visibility, including monitoring, modeling, and control of visibility impairment. This report indicated that present mathematical models and monitoring techniques show promise for use in a regulatory program to protect visibility. However, the report concluded that existing techniques needed further evaluation and development before they could be routinely used in any visibility regulatory program.

Recognizing these limitations, EPA promulgated regulations, as you have heard, on December 2, 1980, which specify a phased approach to visibility protection. Phase I of the current program requires control of any existing stationary source causing visibility impairment in these areas.

EPA is also evaluating control requirements for new sources to prevent future impairment. States are developing long-term strategies and revising their air quality plans to assure progress toward the national visibility goal.

Under the current program, States are to determine whether certain existing stationary facilities should install additional equipment for controlling those pollutants which impair visibility. States must also adopt certain measures regarding visibility impacts that will supplement the States' new source review program. States have the discretion to use available modeling and monitoring information in designing their program. No new monitoring networks are required.

The responsibility for developing a program lies with the 36 States which contain parks and wilderness areas. EPA recently held a workshop to assist States in developing their visibility plans. States in region 10 are presently developing these plans for submission to EPA this fall.

The Federal land manager, as you have heard, has the responsibility of characterizing the visibility of the mandatory class I Federal areas. Therefore, the States and Federal land managers must really work closely to insure that that visibility in these areas is protected.

Another aspect of the visibility program that you have heard about briefly is the integral vista concept. Under the visibility regulations, Federal land managers are responsible for identifying integral vistas which are defined as important views from inside these parks and wilderness areas of scenic landmarks outside the boundaries of the area.

The National Park Service, on January 15, 1981, proposed a list of integral vistas, but no formal or final list has been adopted as of yet.

The States are to consider the potential of new or existing sources to impair visibility of an integral vista. This consideration takes into account factors such as cost of compliance; the time necessary for compliance; the energy and nonair quality environmental impacts of compliance, the remaining useful life of the source, and the degree of improvement in visibility anticipated to result from control.

You have heard in Washington a total of nine vistas have been proposed by the National Park Service, two in Mount Rainier National Park; six in North Cascades National Park; and one in Olympic National Park. Since they are only proposed, there are no real impacts of the program to date. However, the forest product industry and State and Federal forestry agencies have expressed concern about the impact of these integral vista requirements on prescribed burning needed for forestry management.

The Forest Service and the EPA have developed a draft workbook for balancing air quality and land management goals for open burning. In addition, region 10 has formed a policy group to address smoke from logging-enforced activities. The Forest Service, Bureau of Land Management, Bonneville Power Administration, the Department of Energy, States in the Pacific Northwest, and EPA are seeking ways to reduce slash burning through forest residue utilization.

That concludes my formal testimony. I would be happy to answer further questions.

Senator GORTON. What portion of your manpower and your budget goes to the enforcement of PSD provisions in region 10?

Mr. DUBOIS. I don't have a formal breakout of that. I would say of the total regional resources, probably no more than about a few percent, 5 percent or less.

Senator GORTON. Then should it be as difficult, as the previous witnesses testified, for the State of Washington to take over in that enforcement authority? Evidently Alaska and Oregon are going to be willing to do so.

Mr. DUBOIS. They are moving toward that.

Our regional resources here are approximately a staff of 300 people, so 5 percent would be about 15 people.

Senator GORTON. For four States?

Mr. DUBOIS. Yes; I think the 15 would be a little bit of an optimistic estimate, in that there wouldn't be 10 to 15 working all the time, but at times, there may be that many working.

Senator GORTON. On the other hand, even if all four took over the proposal, the increase of their burden would not be matched person for person or dollar for dollar by a decrease in your responsibilities?

Mr. DUBOIS. It would certainly reduce our personnel requirements, but certainly not to zero, because we would need some continuing responsibility with the States.

Senator GORTON. Frank?

Senator MURKOWSKI. You mentioned the establishment of the monitoring stations and the time necessary to obtain the data.

Mr. DUBOIS. Yes.

Senator MURKOWSKI. Then you usually require clarifying information to determine that the application is complete.

In reality, that generally is the situation. My question is, why do we have to—if we have got such a detailed act here—why is it difficult to resolve information once it is made available? I assume that the monitoring has to meet the requirements, and once the time is sufficient to establish an average you have a pretty clearcut case for a decision.

It is my understanding, in general—and maybe it is not the case here—that usually there is significant time and additional cost associated with the "clarifying" information. Why can't we eliminate that?

In other words, the industry is given a set of regulations to comply with to provide the information. Then you have a decision-making responsibility to determine whether it is sufficient. Would you address the "clarifying" matter?

Mr. DUBOIS. Yes; I think probably——

Senator MURKOWSKI. My inference is, does that constitute a difference of opinion within EPA as to whether the information is adequate or inadequate?

Mr. DUBOIS. I think the PSD program is administered almost totally in the regional offices, so we don't have some of the bureaucratic problems of getting it approved here and then at headquarters kind of thing.

The two areas that come to my mind as most often causing the need for additional information or clarifying information—whatever you would characterize it as—after we have received the application initially, but before we determine that it is complete would fall in the area of, one, defining the so-called best available control technology. There is plenty of room for debate in that, frankly, as to just what is the best available control technology.

That definition has in it components not only of purely the technology itself, but the cost of that technology; the environmental benefits that would be derived by applying that more stringent technology; the energy implications of applying it. So it is not a very simple, clearcut determination as to what constitutes best available control technology. That may be one area in which we would go back to a company and say something to the effect, "You have given us a submission here in your application, but we are not sure we understand how you arrived at that conclusion," or "Did you consider this other alternative?" Or something of that sort. That would be one of the clarifying areas.

A second would be in—and maybe an even more difficult area—and that is in the application of air quality models, particularly when a source is proposing to locate in a mountainous area, a complex terrain, as we term it.

The sophistication and the accuracy, and so on, of the models that is available is less than desirable to say the very least, as far as I am concerned. There are many different kinds of air quality models that companies and consultants and EPA has come up with. They each have their supposed values and benefits and certain applications, and so on.

Often there is need for clarification in this area of the air quality models which relates, of course, to the amount of pollution that is going to go out the smoke stack to what it is going to be in the ambient environment and thus whether it would affect the increment.

Those are the two big areas that involve clarification.

Senator MURKOWSKI. Thank you.

I have no further questions.

Senator GORTON. Finally, we will hear from Mr. Weaver from the Washington State Department of Ecology.

STATEMENT OF DARRELL WEAVER

Mr. WEAVER. Senators, members of the committee, my name is Darrell Weaver.

My position is meteorologist of the Washington State Department of Ecology. I have been assigned the responsibility of developing a visibility program.

I would like to thank you for providing this opportunity so that we may comment on the Federal visibility regulations and also to discuss our position on the visibility protection for the State of Washington.

The Washington Department of Ecology believes that it is important to protect visibility in our State. We recognize the value of the visual experience, not only to those who reside here, but to the many visitors who seek out our State's natural beauty. Certainly, Washington's class I areas and their associated integral vistas are among the most beautiful in the Nation and deserve adequate protection.

The Department of Ecology has been working closely with the National Park Service. We support their concern for visibility protection, and are in agreement with their identified integral vistas. We note that the National Park Service has identified no stationary sources as a major impairment to visibility in class I areas or the associated vistas. Pollution associated with our urban areas is some distance from class I areas and usually contained at elevations below the vista points. Therefore, it is our understanding that no BART controls will be required on any existing stationary source in our State.

The Pacific Northwest, including Alaska, differs from the rest of the Nation, as we have no point sources that directly affect visibility in our class I areas or degrade our integral vistas. Also, we have no upwind sources, that is, to the West, to degrade our visibility by the long distance transport mechanisms.

Visibility in Washington therefore has the potential to be truly pristine; a fortunate situation considering the magnificent views Washington possesses. Unfortunately, this situation is not always the case.

The marine air that frequently dominates the Northwest results in many cloudy or foggy days, especially at the vista locations. When clearing does occur, visits to our parks and wilderness areas increase as Washington and out-of-state tourists make an extra effort to experience our scenery. All too frequently, these clear skies soon become hazy and smokey with visibility decreasing to the point where the visual experience is severely degraded.

The emissions from human activities include auto and industrial emissions, but the major source of smoke and haze that degrads our visibility in class I areas is the open burning of logging residue, or slash, as is practiced here in the Northwest.

In 1978, the National Park Service conducted a visibility report as part of their preliminary national assessment of class I related value for the three main parks in Washington State. Slash burning was identified as a major source, besides natural cloudiness, for visibility impairment. Comments from the report for the Rainier National Park section include "Surrounding National Forest Treat Slash by Burning. This is done on a clear dry day when views would otherwise be unimpaired and enjoyment of Mount Rainier visitors depend heavily on visibility. The visibility goal for Mount Rainier National Park should be to reduce visibility impairment to only naturally occurring phenomena related to weather or wildfire, during the months of July, August, and early Septenber."

Some of the reasons that point to slash burning as the major cause of visibility impairment include the nearness and the elevation of many burns in relationship to our class I areas, total emissions from slash burning, particle size distribution of these emissions, and the concentration of burning during clear, dry weather periods.

During 1980, particulate emissions from all industrial point sources in the State of Washington amounted to 87,000 tons. Particulate emissions from slash burning amounted to 22,000 tons if we assume a conservative emission factor of 20 pounds per ton of fuel consumed. The State's largest single source emits less than 5 tons of particulates per day, while one large slash burn can emit 100 tons in a matter of hours. On a heavy slash burning day, slash burns frequently can emit over 500 tons of particulate while all State industrial sources emit only 250 tons.

Here in Washington, the department of ecology has been directed by our State legislature to work with the Department of Natural Resources to minimize the impact of slash burning upon air quality in the State. The two agencies have developed a smoke management plan to accomplish this end. The purposes of the smoke management plan are: To protect the populated areas of the State; and in recent years, to include certain recreational areas during periods of heavy use; to lengthen the burning season to as many months as possible. This insures that we will not exceed health standards; to reduce the impact of the burning by improvements in techniques and if possible, a reduction in the total amount burned.

In this area, I must admit, we have not been too successful; and to prohibit all burning during air pollution episodes.

The plan has been successful in protecting our populated areas by burning only during weather conditions that direct the plumes into the uninhabited regions.

Many of these target regions are now classified as class I areas requiring protection. This creates an obvious conflict if both visibility and urban air quality are to be protected.

The Department of Ecology sees our first priority as protecting the populated areas from intrusion of smoke and protecting the health standards. However, we recognize the importance of good visibility in our class I areas, and will pursue a program that will assure adequate protection of our visibility, especially during periods of heavy public use.

We have identified such periods as the vacation season, that is, from May to the first of September; fair weather periods when any impairment in visibility is very apparent and distracts from the enjoyment of the area; weekends, especially during the fair weather periods; and also I might add that we feel good visibility is not as important during cloudy or rainy periods, or at night.

The WDOE would like to take this opportunity to make some comments on the visibility protection provisions of the Federal Clean Air Act. We feel that the law is mainly directed toward large industrial sources with specific requirements not especially related to Northwest problems. The law should be revised to require each State to identify its specific visibility problems and to develop a plan to deal with these problems to attain and maintain good visibility.

The regional administrator should have the authority to approve the State program, unless an analysis shows improper evaluation or inappropriate control measures. The plan should include a time schedule and a monitoring program to determine and assure progress.

Provisions for time extensions should be provided for. Washington is undertaking an extensive program this summer to include monitoring, source impact analysis and studies on the effectiveness of various control measures. Because of weather, our tourist season and the slash burning activities, our studies will be in July, August, and early September. The current deadline does not allow time for analysis of our studies and formulation of a control strategy; that is, the September 2 due date. A more flexible time schedule is essential to develop an effective and acceptable program. Thirty to sixty days would be nice.

We would also like to take this opportunity to state that economic incentives to eliminate or reduce slash burning are needed. Alternate methods of slash removal will have to become economically attractive, if under current regulations, we are to achieve any reduction in the total amount burned.

Industry, when required to install emission control devices, can cover incurred cost by various tax incentives, depreciation allowances, and even energy credits. Such incentives do not exist for the slash burning. Last year over 2 million tons of slash were burned in Washington State. This is equivalent to the energy produced by a 1,500-megawatt powerplant or the equivalent of the energy contained in over 1 million barrels of oil.

The law and appropriations should consider incentive programs to conduct research and develop alternatives that would reduce slash burning. The benefit would include improved air quality, increased visibility, and better utilization of our currently wasted resources.

Thank you.

Senator GORTON. Do I get the implication from your testimony that the views of the Department are somewhat at variance from those of the timber companies which engage in this slash burning, and that you have got some problems? What you have talked about here is ways that you hope we might help you solve them?

Mr. WEAVER. I notice from the comments that the EPA received on the May 22 regulations, that many from the forestry made the statement that they didn't believe slash burning was a major contributor to visibility degradation. However, going over the mission inventory of our point sources, the location of these sources, the size of the burns and probably most importantly, the characteristics of the emissions—that is, the particle size distribution from open burning—falls right in the maximum range for scattering and adoption of light, which is one micron. You can have an industrial source putting out a lot of pollutants, but the particle sizing might be larger and it is not very effective in scattering light. No matter how we look at it, the indications are, for the class I areas, that it appears that slash burning sometimes occurring even 5 or less miles from the park boundary has got to be a major source.

Senator MURKOWSKI. Mr. Chairman, I have to go.

I want to thank you for the invitation to participate in the hearing.

Senator GORTON. Thank you, Senator. We will see you soon.

For all of you, and any of you who wish to can comment on this. The photographs by Ms. Clark that were displayed earlier showed what are obviously magnificent vistas. We determined that, at least in one case, we saw a mountain 160 miles away from where the picture was being taken.

These are exactly the kinds of vistas which this part of the Clean Air Act was designed to protect, even though no such program is in effect at the present time.

To what extent, in your view, are these vistas actually impaired by man-created activities?

Ms. CLARK. I don't think I have any information.

Mr. TOBIN. We don't have statistics with us, Senator. The parks do have some logs. We can provide that information to you.

Senator GORTON. Did you have to wait a long time to take those pictures?

Mr. TOBIN. No. I was Superintendent of Mount Rainier Park for some years, and I experienced that type of vista frequently. I also am aware that, on occasions of slash burning, that at the lower elevations in these valleys or pockets, the smoke from that type of activity collects; and that it is difficult to even see a quarter of a mile, but that if you raise it on up to the 6,000-, 7,000-foot level, you again see peak-to-peak vistas.

Senator GORTON. One other question which I guess you National Park Service people could come closer to answering than any other on this panel. You heard earlier the comments from both the city of Seattle and from the State as to the great economic importance to the State of Washington is the tourist industry. Large numbers of those tourists are coming to the State, at least in part, to go to the national parks, which you administer.

Do you have any idea or is there any method of determining what the economic value of these vistas are? How many people come to the State primarily for that kind of recreational experience? It's very easy to say that so many millions of visitors are here every year bringing so much money in the State.

How much is the State impacted either by the reality or the hope that these kind of esthetic experiences are going to be available to them?

Mr. TOBIN. I don't believe we have any studies that speak to that.

We have economic studies of Mount Rainier and Olympic National Park, but they don't get that finite to speak to vistas.

They do include statements from visitors as to what attracted them to the area. We can provide some of those as examples of type of attraction.

I would say that for Mount Rainier, as an illustration, that the hopes of seeing the mountain is one of the great lures to the visitor from the State, as well as from outside of the State.

Senator GORTON. Your particular experience with Mount Rainier was that most of the visitors can go to Mount Rainier, Paradise, or Sunrise. Do they go to see the mountain, or do they go to see what you can see from the mountain? I suppose both.

Mr. TOBIN. There is probably a mixed environment, but probably the most attraction is to see the mountain.

Senator GORTON. I would like to thank this panel very much. We will take a 5-minute break before we start with the next panel.

[Brief recess.]

Senator GORTON. We would like to call this meeting to order again.

Would everyone please take a seat?

As we start out, I would like to recognize that Mr. Sharp, the Canadian consul in Seattle is with us. For those of you who don't know it, I can assure you that the Canadian Government has a great interest in the Clean Air Act, especially the great problem of acid rain.

Mr. Consul General, we are happy to have you with us.

The second panel will begin with a presentation from Allan Waggoner from the School of Civil Engineering from the University of Washington.

I understand that you will start with slides; is that right?

STATEMENTS OF ALLAN WAGGONER, ASSOCIATE PROFESSOR OF CIVIL ENGINEERING, UNIVERSITY OF WASHINGTON; JOHN S. LARSEN, VICE PRESIDENT FOR REGULATORY AND ENVIRONMENTAL AFFAIRS, WEYERHAEUSER CORP.; WILLIAM A. KUCHARSKI, ENVIRONMENTAL ENGINEER, PACIFIC POWER & LIGHT; AND RUTH WEINER, CHAIRMAN, AIR QUALITY COMMITTEE, WASHINGTON ENVIRONMENTAL COUNCIL

Mr. WAGGONER. There will be slides interspersed. Unfortunately, they will be shown directly at you.

Senator GORTON. I will have to move out.

Mr. WAGGONER. I apologize for the inconvenience.

Senator GORTON. You may proceed.

Mr. WAGGONER. My name is Allan Waggoner. I am an associate professor at the University of Washington.

The 1977 Clean Air Act Amendment included visibility protection within the mechanism of the prevention of significant deterioration (PSD) procedures. I have been an active researcher in visual air quality for the past 10 years and welcome this opportunity to present my views on visibility and the regulatory process.

Visual air quality was included to protect the national parks in terms of visitor visual experience, and I am in agreement with this rationale. There are additional public needs that justify this visibility protection in wider public areas.

First, degraded visibility such as shown in this slide of Denver, generates public worry about the health impacts of air pollution.

This seems to be much more of a problem, as shown in this slide, where the air pollution is dark and has an obvious upper edge to it. Major air pollution studies in California and in Denver have been largely designed to understand the atmospheric optical effects of air pollution over urban areas.

The research community also has needs for good visual air quality. I am familiar with one aspect of these needs through my role as a consultant to the China Lake Naval Weapons Center, as well as NASA and the U.S. Air Force at Edwards, Calif., all located in the western Mojave Desert, northeast of Los Angeles. These facilities conduct flight tests of such vehicles as the Space Shuttle, B-1 Bomber, et cetera, and test new aircraft weapons systems and tactics. For aircraft safety and to record test vehicle positions by long-range photography, long visual range is required for both.

I would like to show a slide to demonstrate the visual and photographic degradation caused by reduced visual range.

The upper photograph is of a graphics display at zero visual range. The next picture is at 10 percent. The third from the top picture is at 50 percent. The bottom picture is at 75 percent. Notice at least that the dark areas in the 75 percent of visual range photograph, the edge between the object and the horizon are still visual. But to protect the esthetic quality of a vista such as range of brightness and color, the visual range must be substantially longer, perhaps 3 to 10 times the observer vista distance.

The same is true for long-range photography of aircraft. This slide shows the appearance of the aircraft at close distance and at simulated 35 percent of visual range.

The Federal facilities that conduct these tests have a high dollar cost. One hour of range costs about $50,000 at the Naval Weapons Center and are vital to our aircraft and weapons development. The Naval Weapons Center average visual range is now about 60 miles. This appears to be close to the minimum to avoid loss of test time to the facility. The situation at Edwards, nearer to pollution sources in the south coast and San Joaquin Air Basins is more degraded by less documented. These Federal facilities are cooperating with the State of California and other agencies to protect visual quality in this region

In the eastern United States hazes rich in sulfate commonly degrade visibility below 10 miles during summer and constitute a hazard to aircraft operations. Degraded visual range is better understood probably than any other aspect of air pollution in terms of the impacts of specific levels of visual air quality.

EPA has taken a staged approach to regulating visibility choosing to limit the presence of visible plumes as the first step for several reasons including:

Visual impacts of plumes in the Four Corners area of New Mexico was very important to those writing the 1977 amendments; and also plumes can usually be traced to a specific source, avoiding any question as to the source impacting visual air quality.

A series of plume model validation tests have been conducted during the past 4 years and this work is largely complete needing perhaps 1 additional year to complete the data analysis and reporting of results.

In the test location, clean northern Arizona near a major facility model calculations agreed fairly well with measurements of visual impacts. Only the gas No. 2 was important within 100 km of the generating facility in terms of plume appearance.

The next slide is a demonstration of the appearance of the plume from this facility. The plume is the brownish or yellowish discoloration against the sky shown in this slide.

The regional haze appeared to be smog transported with little alteration except dilution from population centers in central and southern California. This is one of many indications that the regional haze is an important problem that must be addressed to protect visual air quality, even in remote clean regions.

I will return to regional haze, but first I would like to discuss another problem both with the way the amendment was written and the way EPA implements its provisions. The amendment and the implementation required protection of visual range, the prevention of visual discoloration, and from the intrusion of visibly detectable plumes into or viewed from class I areas.

EPA has devoted much effort to defining what is visibility and why is a plume discernable. No answer is yet obvious and perhaps it is now time for Congress to more precisely define visual air quality. Photographic simulation techniques of the type I have demonstrated here can accurately produce the appearance of various levels of degraded visual air quality. It also appears that based on some tests of visitor judgment that the visitor does not find plumes as offensive as was originally suggested in the act.

The same type of test suggests that a spatially uniform haze degrades the visitor experience and if the haze is dark and has a definite upper edge, especially the haze generates health worries in the public. As previously described, the haze can also interfere with aircraft operation, testing and long-range photography needed to test weapon systems. Our ability to model optical effects of uniform haze is even better than our ability to model plume optics.

We have only limited ability to model the chemistry that creates the haze. We are in the early stages of creating a model to describe transport over the scales of this problem in the East. Research in this area is clearly required as there appears to be a need for regulation and we need to develop and test models for chemistry and transport on the scale of regional haze.

The need to regulate regional haze comes from not only visibility impacts but also health risks. Degraded visual range is caused by particles smaller than 2.5 microns. And these same sized particles are retained in the lung and are acid and are generally more chemically reactive and contain such materials as lead, which are chemical poisons.

From a source identification and regulation standpoint, ambient particle samples for air quality regulatory purposes should be collected by size as larger, or coarse, and smaller, or fine, with the division at 2.S microns. A paper by Waggoner and Weiss shows that there is a very high correlation between the fine particles smaller than 2.5 microns and an optical measure of the degree of air quality degradation of local air.

EPA in the draft Criteria Document for SO_2 and Particles External Draft No. 2 reviews the epidemiological literature. This review appears not to be able to justify from existing data either a 2.5 or 15 micron inhalable particle standard.

I would like to supplement my testimony here with a little bit of additional information.

It cannot justify the standard on the basis of demonstrated epidemiological studies. There are logical models, and there are animal and human exposure studies that do justify a 2.5 or a 10 to 15 micron standard.

I personally feel that three size resolved particle standards are useful; 2.5 micron and below reduces visual impact and is directly related to health risk; 15 micron or 10 micron below limits particle concentration in size ranges that have created respiratory problems in industrial exposure situations. There is perhaps some value to the TSP high volume sampler based standard to reduce fugitive dust, although it is not directly related to health risk.

There is another relationship between visual air quality and health risk I wish to mention. Nearly all of the pre-1969 health effects studies and a large fraction of the more recent studies have a measure of the darkness of a spot of particles sampled on a filter aerosol particle collection to determine particle concentration. These studies demonstrated a relationship between the darkness of the spot and health risk.

We now know that this dark spot is due to soot and that soot causes 15 to 40 percent of visibility reduction in urban areas. Society is now making changes such as wood stoves and increased diesel auto engine utilization that will increase soot emission, degrade visual air quality and increase ambient concentrations of material that has a historical link to degraded health.

In response to specific questions of Mr. Davenport of your staff, I will comment on the degree of pollutant limitation to protect vistas, and to limit my time, I will drop the next six sentences or so.

In clean areas, there is always some visual haze because the air molecules have some optical extinction due to scattering. Increases in extinction by particles above this will degrade visual range and degrade appearance at all distances above a few kilometers. Based on measurenent of fine particle mass and scattering extinction, degraded visual air quality takes place in clean areas at 3 to 5 micrograms per cubic meter of fine particle mass. For areas with preexisting fine particle mass a change of something on the order of 20 percent above existing levels probably would produce a discernible effect.

I can show this in a pair of slides of the Seattle area. This is Capital Hill as viewed from a distance of about 2 kilometers away on a clean day where the fine particle concentration was about 5 microns per cubic foot; and this is the same scene with about 15 micrograms per cubic meter.

In both cases, the visual range is sufficient that you can clearly discern the horizon edge, but the scene is degraded. There is the clean photograph again.

Mr. Davenport[1] also asked me to comment on integral vista and I can think of nothing more profound than to say I advocate the concept. For those national parks that have as part of their value views extending outside the park boundary, their view must be protected to preserve the value of the visitor experience.

In closing, I have one last comment. We at the University of Washington have conducted research in visual air quality for more than 15 years. I have been a research scientist in the program for 10 years. This stability has made possible our contribution in this field. Changes in research funding to decrease support available, increase uncertainty, and reduce period of research programs would make our accomplishments much unlikely under current conditions. There is now an instability that decreases useful scientific research at a time when we are ignorant in areas that will require action.

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[1] Jim Davenport, Assistant Counsel, Committee on Environment and Public Works.

Thank you.

Senator **GORTON**. Thank you.

We can have some lights at this point.

I believe that we will go through the entire panel before we have any questions.

Next on the panel is John Larsen of the Weyerhaeuser Co.

Mr. **LARSEN**. Thank you, Senator Gorton.

STATEMENT OF JOHN S. LARSEN

I am Jack Larsen, vice president for Weyerhaeuser Co. I very much appreciate the opportunity you have presented me to testify before this committee. It is a very special pleasure, Senator, to have you back in your home State. I will summarize to the extent possible, the full text of the written testimony that I have supplied your staff.

I am testifying today on behalf of the American Paper Institute and the National Forest Products Association. My testimony will be limited to only two issues: The concept of integral vistas and the process that was undertaken for the selection of those areas for visibility protection.

In the 1977 Clean Air Act Amendments, Congress established a program to protect visibility in certain pristine national parks and wilderness areas where it was determined that visibility was an important value. After a 2-year process of rulemaking, final regulations entitled "Visibility Protection for Federal Class I Areas," were published by the Administrator of EPA. It is the implementation of these regulations that is of such serious concern to our industry.

The first issue involves what EPA refers to as "Integral Vistas." Under the visibility section of the Clean Air Act, EPA has asserted authority to regulate emissions that may impair the visibility of "integral vistas" which are defined as the views from landmarks or panoramas looking out from points within certain national parks and wilderness areas. By this action, the EPA has gone far beyond what we believe the people would concede is a legitimate purpose, that of the Federal managers' involvement in protecting visibility within the boundaries of our most scenic public lands.

Instead, the Federal agencies are attempting to place millions of acres of non-Federal, State, and private lands under these regulations. Such regulations will only duplicate other air regulatory programs established at the State and local level which have been established by this same statute and which are intended to assure that congressional goals for air quality protection are met.

Compounding the confusion caused by this duplication is the fact that this proposed program also gives Federal land managers the authority to decide what views are to be protected as "integral vistas," thereby asserting a Federal authority over private and State lands.

I can find no basis in either the statute or its legislative history to suggest that Congress meant to do more than protect vistas within our most scenic Federal areas. It is the Agency's position that there was an implied intent on the part of Congress to institute such provisions. I am here before you today seeking some congressional clarification of that issue.

Although EPA's authority to regulate "integral vistas" was a key issue in the rulemaking, neither EPA nor any involved Federal land management agency actually defined the concept in its actual application until after adoption of the rules. We were therefore surprised to find that the concept of protecting integral vistas would extend outward, well beyond the boundaries of Federal lands.

It was not until several months after adoption of the visibility regulations, that we learned just how far this authority was going to extend beyond the class I areas. Let me show you how extensive this would be in western Washington. The map to the right shows the three national parks impacting western Washington. The overlays that I am about to show you illustrate the National Park Service's proposed regulations. They were taken directly from the descriptions in the regulations.

This first overlay gives one example, Tolme Lookout, which is a viewpoint proposed by the Federal land manager in Mount Rainier National Park. The heavy blue lines which you see encompass the angle of view. The shaded portion is the vista to be protected. The lighter blue lines indicate other specific vistas of importance. In this case the specific vistas are Mount St. Helens to the south and Mount Baker and Glacier Peak to the north.

The second overlay adds two more viewpoints proposed by the North Cascades National Park's manager. Again, the heavy lines indicate the angle of view and the shaded area the vista to be protected.

The third overlay shows all of the various vistas proposed by the three national parks which affect western Washington. You will note there is one additional viewpoint in Mount Rainier National Park; two additional in the North Cascade's National Park; and one additional in the Olympic National Park.

This map is somewhat confusing, but it does vividly illustrate the extensive coverage of western Washington by the Park Service proposals.

Nearly half of western Washington is covered, but more importantly, nearly all of the populated, industrialized area, as shown by the shaded portions of this final overlay. What this means is that any new industries within the shaded portion of this map that have air emissions are subject to review by the Federal land manager.

I want to clarify a point which I think was confusing in some of the testimony earlier in this hearing.

The Federal manager does have the power under the regulations to deny approval of any new industry, and he also has the power to require more restrictive controls for industry within these areas. Only the Governor of the State can overturn these denials. Their responsibilities go far beyond those of just an identification of the important vistas. If that were the only responsibility being represented by these Federal agencies, I would not be here before you today, Senator.

You will note the overlap that occurs between integral vistas from viewpoints from these three parks. In many instances, on any particular point in those shaded areas, all three Federal land managers would be involved in the same decisionmaking process.

In addition, these maps only consider the proposals from the three national parks. They do not consider the implications of U.S. Forest Service proposals for viewpoints from wilderness areas and national forests.

We believe these are simply inappropriate responsibilities for Federal land managers. We strongly support a visibility protection program on the part of the State and local entities for these areas. These visibility provisions as they are presently constituted, we believe to be badly conceived. They're sure to create costly regulatory duplication, and they will be confusing for both industry and the public.

The second issue I would like to briefly address concerns the selection of areas for visibility protection. In our opinion, EPA and the Department of the Interior failed to adequately address a key threshold question which Congress assigned them in 1977. The statute requires the Federal agencies to make an in-depth determination as to which of the Nation's national parks, national forests, wilderness areas, and other mandatory class I Federal areas warrant special visibility protection.

Our review of the Interior Department's files indicates that the initial selection of areas to be classified within national parks was done with little or no individual study or assessment. The result was a finding by this agency that out of 158 mandatory class I areas, 156 of them required visibility protection. Some of these areas, it seems to us, just do not meet a reasonable test as to whether they are areas requiring additional protection in order to preserve the view of the scenery within them.

Senator GORTON. Are any of those within the State of Washington?

Mr. LARSEN. No, sir.

Senator GORTON. Go ahead.

Mr. LARSEN. At the very least a more definitive study is needed before making the selections.

Taken together, EPA's asserted authority to regulate "integral vistas" outside of the Federal boundaries, and the designation to date for special protection of virtually all class I areas being given consideration, expands the visibility protection program far beyond what we believe the Congress carefully contemplated and intended in 1977.

I urge you to give careful consideration to the implications of having this program implemented as proposed. In doing so, I believe you will share our conclusion that these portions of the visibility program are not in the public interest.

In my opening remarks I indicated that I would concentrate my testimony on only two issues: The concept of integral vistas and the process for selection of areas for visibility protection. I also indicaed that my purpose in being here today is to seek congressional clarification of these two issues.

In my judgment this can be accomplished by either of two approaches: The first would be for this committee to make more specific the legislative record on the two issues during its deliberations and to follow this up with a letter to the administrator clarifying your intent; the second approach would be to amend section 169(a) of the Clean Air Act so as to make more specific the intent of Congress in the statute.

I leave it to the wisdom of this committee to decide what approach would be the most appropriate; however, I hope you will give the matter your serious attention.

Senator GORTON. Thank you. I think we will defer questions until all of you have completed. We will go on to Mr. Kucharski and note that your written testimony is fairly complex. I hope that you will try to summarize it.

STATEMENT OF WILLIAM A. KUCHARSKI

Mr. KUCHARSKI. Yes, I have, Senator Gorton.

My name is William Kucharski and I am the senior environmental engineer for Pacific Power & Light. On behalf of Pacific and Puget Sound Power & Light Co., and the Washington Water Power Co., I would like to thank you for giving us this opportunity to present our views on the effects that specific portions of the Clean Air Act have on the electric utility industry in this State and the Nation.

I am also presenting the views of Western Energy Supply & Transmission, WEST Associates, of which Pacific is a member. Founded in 1964, WEST Associates is a research and planning group of 21 electric utilities in the West and Southwest. WEST member utilities include all sectors of the electric utility industry: investor-owned, publicly owned, and rural electric cooperative. Member companies service a population of approximately 18.8 million people in several States, including Washington, Oregon, Idaho, Arizona, California, Colorado, Nevada, New Mexico, west Texas, and Wyoming.

Let me state at the outset that the air quality in Washington and Oregon is of great concern to our company. Pacific serves over 1.2 million customers in Washington and Oregon with a resultant power load of approximately 1,720 average megawatts. By 1990, this load is expected to increase in Pacific's Northwest service population. By 1990 the two-State area is expected to increase an additional 19 percent. The power needs associated with this growth will be accommodated by applying modern conservation techniques, utilizing renewable resources, and by constructing new coal-fired generating facilities in the Northwest.

Pacific is part owner and operator of the largest coal-fired facility in Washington and Oregon, the Centralia powerplant. Centralia is a 1,330 megawatt coal-fired electric generating facility located approximately 45 miles west-southwest of Mr. Rainier.

We believe, Senator, that certain modifications to the Clean Air Act would be beneficial both to the people of Washington and to the Pacific Power & Light.

While a great many changes in the act have been proposed and may well be desirable, I would like to focus on two primary issues that are of particular importance to Pacific, that is, prevention of significant deterioration, visibility.

Much greater detail than I will speak to today can be found in the written testimony submitted earlier. My major emphasis will be on visibility so the section on PSD has been reduced accordingly in this verbal presentation.

We believe the prevention of significant deterioration, or "PSD", program should be revised substantially.

Specifically, we would recommend that the short-term (3- and 24-hour) increments be dropped from the PSD as they are applied in the PSD program; that procedures be streamlined so that permit and review requirements for new facilities which essentially duplicate existing ones can be expedited; and that you carefully consider the recommendations of others that class II and III areas be eliminated.

Our second and main topic of concern today, Mr. Chairman, is the set of visibility regulations adopted recently by EPA. Speaking for Pacific and its two sister utilities, I will state that we are deeply concerned about how EPA has construed section 169(a) of the act to protect what it calls "integral vistas".

The situation here in Washington is an excellent example of the problems facing the utility industry as a result of the EPA interpretation or misinterpretation of congressional intent in regard to visibility protection.

My map is not as fancy as Mr. Larsen's.

But it does indicate the three class I areas, the resultant integral vistas, and this takes into account the majority of the areas that the Park Service said were part of the integral vistas, the orange lines with an indication of what are called the zones of influence, that is, a powerplant of—a thousand megawatt powerplant, coal-fired plant, that was located inside those orange lines would be felt to impact the visibility within the class I area, not the integral vista itself, because it is in the integral vista already, but within the class I area, itself.

I might add that the class I areas in the State account for approximately 2,500 square miles. The area that the integral vista concept impacts in the State is over 30,000 square miles of the State.

Nationwide, a similar situation exists. Those National Park Service class I areas that have integral vistas associated with them total approximately 20,000 square miles. I would also point out that only 2,100 square miles of that is located east of the Mississippi and the integral vistas concept influences, it is estimated, over 55,000 square miles of the country. The impact of integral vistas on the State of Washington graphically illustrates the immense influence the 1977 amendments of the Clean Air Act can have on this Nation.

The issue of visibility protection in Federal areas—such as national parks and wilderness areas—or how far and clearly one can see distant vistas is just one issue in the clean air debate where energy, environment and economics, the three "e's", clearly collide.

Sections 165, 169, and 169(a) of the 1977 Clean Air Act Amendments lay out a strategy to protect visibility. Regulations promulgated by EPA in December 1980 seek to execute that strategy.

There is serious doubt whether current visibility strategies will yield demonstrable and definite air quality or esthetic benefits. A major reason is that EPA's visibility rules lack a sound, well-developed scientific and technical foundation.

Understanding of the causes and sources of visibility impairment still is in its infancy. How to measure and define visibility impairment still is essentially unresolved, as is how to predict future visibility impairment.

WEST Associates projects that the requirements for retrofitting additional emissions equipment on powerplants subject to the current EPA visibility rules would cost the customers of WEST utilities up to $3 billion. The findings of recent studies, such as VISTTA, show that even expenditures of this magnitude will not guarantee any improvement in visibility.

The visibility strategies add yet another layer of costs onto skyrocketing energy prices—costs that weigh especially heavily on people who can ill afford them. Consumers will ultimately pay, in the form of higher energy bills, the costs required to comply with any visibility program, whether they are scientifically founded or not.

In summary, the recommended refinements to section 165, 169, and 169(a) of the 1977 Clean Air Act Amendments that we would like to see carried out—there are five. One would require that visibility protection strategy be based on a 15-year program of progress, with the first 5-year set-aside for a scientific study to be reviewed by Congress before further legislation and/or regulation regarding visibility is undertaken.

Two, to identify, in the 5-year study, the natural and man-made factors in and relative contributions to visibility impairment and develop validated computer models to predict contributions of each.

Three, to delete visibility as a siting review criterion for new sources given scientific uncertainties;

Four, require that any future decisions which might require additional emissions control equipment on major stationary sources be based on clear criteria including cost, energy consumption, remaining life of the plant, plus any benefits to be achieved; and lastly, to delete the concept of "buffer zones" or "integral vistas" around certain areas by limiting the applicability of any future visibility protection activities only to those areas within the boundaries of mandatory class I Federal areas.

I would also add an enlightenment of what the spokespersons from the Park Service said about not having identified any industrial sources in the State of Washington which impact any class I areas; that the current regulations allow that determination to be made at any time.

The fact that the determination has not been made today does not preclude the Park Service, the Federal Land Management from making that decision tomorrow.

This concludes my prepared statement, and I would be pleased to answer any questions for you.

Senator GORTON. Thank you.

Ms. Weiner?

STATEMENT OF RUTH WEINER

Ms. WEINER. Thank you, Senator.

My name is Ruth Weiner, and I am a resident of 1328 23d Street, Bellingham, Wash. I am professor of environmental studies at Western Washington University, where I have been a faculty member for 7 years. I have been teaching courses in air pollution and dispersion modeling over the last 10 years. I am here today representing the Sierra Club and the Washington Environmental Council.

I would also like to point out, Senator, I served on the National Air Pollution Control Techniques Advisory Committee, and was appointed to that committee by President Nixon.

I would like to thank you very much for having a hearing here in Seattle enabling those to attend who could not attend in Washington. I would only hope that there will be public hearings held on this important issue around the United States to give the general public an opportunity to testify more than they can in this general arrangement.

I have included testimony on all facts of the Clean Air Act in what I am submitting for the record, but I will limit my oral comments to testimony on prevention of significant deterioration.

The organizations I represent have been ably represented by Dr. Wagner in his statement on visibility.

PSD policies were mandated by a 1973 court decision that the people of the United States had a right to the preservation of air that was cleaner than what is permitted by the Federal ambient air quality standards. Section 101(b) of the Clean Air Act reads:

> The purposes of this title are * * * to protect and enhance the quality of the Nation's air resources.

Protection is the key to a PSD policy: it implies maintenance of the condition of an airshed, even if that condition is cleaner than the rest of the law permits.

It was recognized early on that since deterioration could result from as small a change as one additional automobile, all deterioration could not be prevented and the concept of significant deterioration was launched. This concept is defined in the current act and as with any legislative definition, is somewhat arbitrary and represents a political compromise, the compromise between the cost of pollution control to both the polluters and the general public and the public welfare and enjoyment of clean air resources.

It is not a compromise with health which is protected by the ambient standards. The PSD policy, however, assists materially in health protection, since the healthfulness of the air is directly proportional to its cleanliness. Many of us would like to see a more stringent PSD policy in several respects. First we would like to see an extension to all criteria pollutants, instead of the current limitation to sulfur dioxide and particulate matter. Not only are some class I areas threatened by pollutants resulting from automobile exhaust, ozone in particular, but there are an increasing number of stationary hydrocarbon sources which threaten such areas.

Then a more stringent policy could be promulgated if the PSD regulations were based on incremental emissions into an air basin. I suggested such an approach in testimony in 1974.

Current provisions of sections 160 through 169 and 169(a) of the Clean Air Act should be retained and in some cases strengthened. Both class I and class II designations are vital to airshed protection.

I would like to talk about class II first, since this has been mentioned.

Section 163(b) allows increments for class II, which amount to approximately one-third of the corresponding Federal ambient secondary standard except for the 24-hour particulate matter increment which is closer to one-fourth of the Federal secondary standard.

Since most of the United States is class II and since the sort of development by heavily polluting industries envisioned in most of the country involves a dispersal of such industries rather than heavy concentrations in any given area, these increments provide a good balance between industrial growth and airshed maintenance. We recognize that there are no nonpolluting industries and that any heavy industry growth will result in increased air pollution, even when the standard of lowest achievable emission rate is applied.

It has been argued that monitoring and dispersion modeling necessary to determine compliance with class II are too cumbersome and expensive and that the modeling in particular is inaccurate and can be distorted to suit the purpose of the group doing the modeling. I would like to argue strongly for retention of class II.

In the first place, I live in a community which represents an ideal application for class II. Bellingham is a community of about 50,000 people. There are several heavy industries, notably a sulfite pulp mill in the middle of town, but there is good dispersion and the air currently is quite clean. Without the protection of class II increments—because Bellingham does anticipate an influx of industry and is probably one of the better locations for new industries in the Puget Sound region—without the protection of the class 2 increments, Bellingham and communities like it throughout the United States would be swamped by heavy industries in the next decade.

It is difficult for new industries to move into nonattainment areas and airsheds that are currently near the secondary standards and such airsheds should probably not have the burden of any more polluters because of attendant health problems. Without class II, communities like Bellingham will become the Gary, Ind. of the West. Class II assures dispersal of new industry.

Sections 165 (b) and (e), subparagraph (2) require 1 year of monitoring and a model of the impact on the airshed of any proposed source which will emit 50 tons of pollutant or more per year. Fifty tons is quite a bit. This amount could result in ambient ground-level concentrations which would exceed the 24-hour primary standard for nitrogen dioxide or the 24-hour maximum increment of sulfur dioxide. My point is not that these excesses happen, but that the minimum size of these facilities should not be increased in the act.

The 1-year monitoring requirement has been assailed, however, for monitoring to mean anything, it must go on over a 1-year period and it should be continued. Ambient concentrations of pollutants, what is in the air, depend most heavily on wind direction and atmospheric stability. Wind direction, wind speed, and atmospheric stability, in fact, determine what the ambient concentration of the pollutant will be, along with what is emitted into the air. The wind shifts throughout the day, and there are large shifts in wind direction during the year.

Monitoring for 1 or 2 days or even for several days spread throughout the year can give a completely false picture of pollutant concentrations. Monitoring for several days each week throughout the year would give more adequate data, but if that sort of monitoring system were set up, one might as well monitor continuously. Without adequate monitoring, there is no way to assess the impact of a new source on an airshed. Even if there are no major stationary sources in the area, monitoring is needed to measure the pollutants brought in by long-range transport.

Moreover, the adverse effects of air pollutants on health indicates that we should have comprehensive monitoring networks in place anyway.

Dispersion modeling has been criticized as being arbitrary. It is certainly true that modeling can be manipulated, but it is equally true that manipulation is easy to detect and discredit. Without modeling there is no way to assess the environmental impact of a source which has not yet been built.

Air dispersion models are part of most environmental impact assessments. NEPA and most State environmental policy acts require it as do many zoning change actions. In short, this is a recognized readily implemented technique for assessing the impact of a proposed facility on the air environment. It is not burdensome and ought, indeed, to have been done prior to construction of air contamination sources for the last 15 years, not just since 1977.

It is, in fact, a cheap way to determine just how much polluting a source is doing and where the specific best location for a pollution source should be to minimize its adverse effect.

We do too little airshed planning, and it is the easiest way to minimize adversary pollution effects. For this reason, if for no other, the current requirements for class II should remain.

Finally, to my knowledge, there has been no case where the existence of the class II increments has hampered industry siting or prevented industrial construction. Class II is, in fact, representative of what polluting industries should have done by themselves, but never did since they never admitted to any adverse impacts prior to passage of the Clean Air Act.

It has been suggested that the 24-hour and 3-hour maximum increments should be eliminated and only the annual geometric mean remain in the law. This would make a mockery of prevention of significant deterioration. The annual mean is just that: An average of high and low concentrations of pollutants, and I have given some cases, where if we only had the annual mean, the 24-hour levels could be much higher than—the 24-hour increments could be much higher than is currently permitted. An individual experiencing polluted air experiences the short-term maximums rather than the annual averages and enforcement is done on the basis of short term.

My comments on modeling, monitoring and the retention of short-term standards, of course, apply to class I designations as well as class II. Class I is intended to protect those areas of the United States whose natural state is protected by other legislation as well: National parks, wilderness areas, and so on. This protection serves a vital purpose, other than esthetics and recreation, however, the preservation of clean air reservoirs, which will ultimately be needed to dilute the existing pollution. We have failed to provide such reservoirs in some parts of the United States, particularly in the Northeast, with the result that an entire section of the country is now polluted.

There are only two methods of cleaning air: Rain and dilution with clean air. The preservation of clean air reservoirs was one of the moving arguments for PSD in the first place.

Most of the United States is not class I. The additional class I designations which are currently allowed under section 164, each if made wherever possible, would result in only a small fraction of the United States being class I. The major argument for class I is not that there aren't many such areas, but that it is in the American tradition of land and natural heritage preservation and is consistent with a century of American policy toward its unique public lands.

There are also some areas that I mention in my statement, Alaska, in particular, where there are particularly fragile airsheds and the existence of these class I areas, again, helps in assessing the unique air pollution problems which are caused in Arctic climates.

Inclusion of the remaining criteria pollutants under class II is essential to better airshed planning. We should definitely not wait until all the urbanized areas of the United States become nonattainment areas before expanding class II. It would be too late, then. Class II is not so much restrictive as it is a planning tool. Moreover, we can then take into account the effects of stationary hydrocarbon emitters, ports, tank farms and refineries. The intent of Congress was to include all criteria pollutants under PSD eventually. We need to meet that intent.

I would like to close my oral testimony by including two points: First, slash burning is important as far as visibility considerations of North Cascades National Park. I live approximately 50 miles from North Cascades National Park.

Second, none of the amendments proposed by Mr. Larsen or Mr. Kucharski have been proposed or supported by any health professionals, groups concerned with health; any citizen consideration or any environmental organization. They are all those proposed by the industries which are regulated.

Finally, a Harris poll released on June 11 indicates that 80 percent of those polled either think that the Clean Air Act is fine as it now stands, approximately half of them, or that it should be more stringent, not less stringent.

I represent a large number of citizens when I urge you to tighten up some of these provisions of the Clean Air Act.

Thank you.

Senator **Gorton**. Ms. Weiner, I was particularly interested in your defense of class II designations. When you speak of your home town, Bellingham, is simply that without class II designations there would be a strong tendency for industrial growth to take place outside of nonattainment areas and in areas such as Bellingham?

Ms. **Weiner**. That is right. In fact, industrial growth is taking place there right now. We have a proposal for CB&I Bridge & Iron to put in a large oil drilling facility. There has been talk of a coal port in the area. There has been recurrent consideration of additional refinery passage.

Senator **Gorton**. My philosophical question about the function of the Federal Government in this area, in a sense, stems from that. Let's assume, at least for the purposes of this question, that we have adequate national ambient air quality standards which meet the present requirements of what we might call health-plus. Why is it once that set of standards has been adopted and applies over the entire country, and once we have certain generally applicable new source performance standards, that the National Government should prevent local decisionmaking in areas such as Bellingham as to whether or not the people there regard as more valuable substantially new industry as opposed to air standards which exceed the quality requirement of those national air quality standards?

Why isn't that appropriately a State or a local decision once the National Government has set certain minimum which meet all these health standards?

Ms. **Weiner**. I don't think it is a case of the national Government preventing the State or local entity from bringing new industry in. Rather, what I would see class II as is as providing a planning framework which has been worked out at the Federal level, which we in Bellingham have no way got the research available to do within which the community can then operate. I mean, if we say to the planning council in Walker County, or something, "Look, this is a class II increment. It isn't—this is an allowed increment. We can bring in industry up to this particular increment," which is plenty of industry, incidentally, in the Bellingham area.

Senator **Gorton**. Would it cover everything that is planned to come through this?

Ms. **Weiner**. Everything—well, without the hydrocarbon standards, refineries might not be—in other words, there might be a change with refineries, but to the best of my knowledge, currently, the three things I mentioned would be covered within this. This is essentially the national word, that we are planning our airshed so that it stays relatively clean, because clean air is important.

We have a large tourist industry. We have a growing number of people that retire to Bellingham.

That gets me to the second part of your question, which is, that the national secondary ambient standards—for one thing, mostly, the primary and secondary ambient standards are right now the same number; except for sulfur dioxide and particulates, they are. The national secondary ambient standards were a political compromise, as all such things are. They're not real clean air.

Bellingham right now is well under the secondary standard most of the time, largely because we don't have a standard for odor.

The air is perceived as being very, very clean. We did a study and asked the citizens in Bellingham, do you think the air is very clean? We don't have that much automobile traffic.

It is in the interest of the community to protect that. I think the community wants to protect it, and what class II tells them is, "This is what protection means." Now, we could petition to be class III if more were desired. But it is more a guideline for the community than anything else.

Senator **Gorton**. Thank you.

Mr. Larsen, in the earlier panel, Mr. Weaver of the State Department of Ecology has testified that the visibility goal for Mount Rainier National Park should be to reduce visibility impairment to obviously natural occurring phenomenon, relating to weather or wildfire as in July, August, or September. I would gather from that that would mean the prevention of slash burning during those 3 months within these rather extensive vista areas that you have outlined here.

What effect would this have on current lighting processes and what would be the economic cost of preserving such regulations?

Mr. **Larsen**. It would be twofold: Historically, our industry did tend to burn the slash in the fall months and in the spring period, when we had heavier levels of moisture. We do not get satisfactory burning in those kinds of conditions, but it is a safe time to burn.

We do not get the release of the fire and the wildfires as a result.

For the very reason of an increasing public concern with regard to visibility, the industry has taken on higher costs and higher risk to try to burn within the periods of time when we do not get the inversions that cause smoke to lie in these—in the valleys and to be dispersed in low-level areas. So during the period of the seventies the State of Washington was very instrumental in developing a smoke management plan which really started to push our industry to examining new techniques for slash burning during these summer periods.

The major objective of that was one of air-quality protection. I think we would find a basic conflict in what he has suggested.

Senator **Gorton**. From what you have been doing and what you consider to be better smoke management techniques?

Mr. **Larsen**. Obviously, in assuming the higher risk—and that is certainly something we must learn to live with—we have been refining the techniques for burning and for protecting these areas. We do find we get much cleaner burns, and we are able to shorten the time of burning very significantly when we are able to burn in the summer periods. But the cost is much higher.

Senator **Gorton**. Do you foresee, at any future time within the planning end of the companies which you represent, an economic use for what is now simply the waste of slash that would substantially cut down on the amount of slash that is burned on the ground?

Mr. **Larsen**. There is a tremendous economic incentive for us to try to get as much of the material off the ground as we can. Markets are such, and the kind of tree is such in the future that certainly the amount of material that we will have to burn will be very significantly reduced.

As we get out of the old growth situation, with a lot of decay, a lot of residual materials that we are not able to use, that are manufacturing products, we will be able to take those into the manufacturing facility.

Certainly there will be less emphasis on burning, but that is not the situation today.

Senator GORTON. You did testify that you supported the State program for visibility as opposed to a Federal program.

Mr. LARSEN. That is correct.

Senator GORTON. How about integral vistas?

Mr. LARSEN. We would have no objection to a definition of integral vistas, as these Federal agencies have done, so long as the implementation of a control program was by the State and local entities.

What we see is a very confusing duplication of effort. The major concern that we as an industry have is the great uncertainty with regard to our management plan, whether it be slash burning or the expansion of an existing facility or the creation of a new green field mill in these areas, when we have to work with so many entities and levels of government in securing the approvals and permits.

We see the extension of the Federal managers from the Park Service and from the Department of Agriculture into this very complicated process; it is just a—creating a much greater problem than is really essential in order to protect air quality.

Senator GORTON. Mr. Kucharski, your acronym WEST covers a substantial number of utilities; they are both publicly and privately owned. It apparently does not include in its membership Seattle City Light?

Mr. KUCHARSKI. No, sir.

Senator GORTON. This does not mean it does not represent or share the views you have expressed here today?

Mr. KUCHARSKI. It wouldn't be in a position to say one way or another. I would hope they share our views. I have not talked to them.

Senator GORTON. Is the organization for more; that is, broader purposes, to be set by the Clean Air Act?

Mr. KUCHARSKI. Yes, sir. It is a group that was put together with the utilities in the western region of the country that have fairly unique problems as compared to the eastern part of the country, and the utilities have gotten together to develop powerplant projects together.

It is a trade organization for the western-based utilities rather than the eastern based.

Senator GORTON. Would it be safe for us to assume that the views of the Mayor are closer to the views of Seattle City Light than the views you have expressed?

Mr. KUCHARSKI. I wouldn't want to make that judgment, either.

Senator GORTON. Dr. Waggoner, I think we have all started into this visibility question with the view that it was an esthetic resource. Some of your slides indicated that it is very much an economic resource at least as it relates to the defense training activities with which you have been associated.

Can you give any other instances in which it is an economic resource except, obviously, for the fact that tourists like to see these long vistas? Have you come across any other examples more similar to the defense examples that yo : used?

Mr. **WAGGONER**. In the entire eastern third or so of the United States, the average visual range in the summer is something on the order of 10 to 15 miles. There are periods when the regional haze is sufficiently dense that it forces instrument flight rules on aircraft which certainly increases economic cost because it reduces the frequency with which planes can land. It increases the time planes are held in the air; it increases fuel consumption, et cetera.

There are safety costs to this, also, even if you are somewhat above the 3-mile visual range, in that you are decreasing the safety of aircraft operation.

It is not a discontinuing step function. Aircraft safety and efficiency and cost are degraded by the haze in the East which appears to be mainly due to sulfate particles in the air, some of which is undoubtedly natural and supposedly the major fraction of it is due to man's consumption of fossil fuels containing sulfur.

Senator **GORTON**. Could you give me a couple of comments on the forestry management slash burning? What proportion of visibility degradation in the Pacific Northwest do you think it represents? Is it ordinarily a plume-type or a diffused smoke which creates regional haze, or does that depend on weather conditions?

Mr. **WAGGONER**. It depends on the weather conditions. The forest managenent burns are usually discreet events, and the forest industry attempts to minimize various environmental hazards of these.

The perception of the various hazards have changed with time. You want to do it efficiently.

You want to reduce the risk of fires burning out of control. The Clean Air Act amendments and increased consciousness of visibility have changed the ground rules by which these decisions are made. I believe the forestry is making an honest attempt, undoubtedly encouraged by the regulatory process, to reduce these impacts.

In most areas, the visibility degradation is not due to the burns. It is due to the complex sources that are a part of the urban industry, which is a mix of some industry; some home heating oil; some automotive emissions. To be honest, we have only approximate ways of assigning various fractions to these, but it is a regional scale, Puget Sound problem and not just particular industries.

Senator **GORTON**. Finally, I would ask you or Ms. Winer or both to react specifically to Mr. Larsen's specific suggestion in this area.

Mr. **WAGGONER**. On the integral vistas area?

Senator **GORTON**. Yes.

Mr. **WAGGONER**. It is a severe problem. The graphics do show that a very large area in the State of Washington would be covered by the integral vistas as defined under some circumstances.

I don't think I would agree with that large of an area. I think what you should be attempting to protect with the integral vista concept are those relatively near, relative prominent features. This is a judgment question. It should be that their position—their position that their judgment may be more coherently and uniformly applied by the State agency rather than the individual Federal land manager has some appeal. Because there is such a range of the scale of parks and training and opinions of the Federal land manager that it really does make it very difficult for the industries regulated under this procedure.

But I would not accept the position that may not have been taken here; that there should be a wall, in terms of the regulatory process, created at the park boundary; and that there are many parks where what you can see from vistas is extremely important from the visitor experience, and that has to be preserved.

It is a compromise. I can't be much more specific than that.

Senator GORTON. Ms. Weiner?

Ms. WEINER. I can just echo that. As a frequent visitor and hiker in North Cascades National Park, I want to tell you that vistas, both into and out of the park, are extremely important to that particular recreational experience.

There is also——

Senator GORTON. All right, but let's go back to the map. Does a park manager have any authority to veto this?

Ms. WEINER. I think this has been cast in a black and white aura, which the annual implementation of the Clean Air Act in all its aspects never had. For one thing, we do know we have a system, all meteorological curtailment is sometimes referred to as the rythem method of pollution control, you can have increased emissions on days when the ambient air permits it, and decreased on days when the ambient air doesn't permit it. I think this is part of what Mr. Weaver was suggesting.

The area, I would have some quarrel with just drawing large scales like that. It depends very heavily on where the wind is blowing and where the source is in connection with where the vista is. There are some vistas that are totally unaffected by heavily polluting industries located not very far from them.

I would point, for example, to the industrialized area of downtown between the interstate and the water. There is a lot of stuff going into the air, a lot of sulphate. To what extent it even impacts the vistas into and out of Glacier Peak Wilderness, I think, is currently open to question.

I would hate to see us give up the opportunity to control something just simply because this broad picture has been painted. It is a compromised area, but I think we can reach a compromise and we should.

We shouldn't say, "Let's not do it because this is the case of most total effect."

Senator GORTON. I should like to thank the panel very much for its contribution.

We will reconvene very promptly at 2 o'clock, so that we can hear our final panel and have as much time as possible for those who have signed up as individuals to testify.

[Whereupon, at 12:35 p.m., the hearing was recessed for lunch to reconvene at 2 p.m., the same day.]

AFTER RECESS

Senator GORTON. It is 2. I see that we have several members of the next panel here. To the extent that we can get all of them here, we will be able to start.

Before we do so, however, after having had the privilege of having Senator Murkowski here this morning, we will have before us for a brief time this afternoon, Congressman Pritchard, who is just off the plane from Washington, D.C., and who has had a long interest in this area, was a part of the renewal and slight changes in the Clean Air Act of 1977.

I would like to welcome him here and have him make a few remarks. He has several other things he wanted to comment about.

OPENING STATEMENT OF HON. JOEL PRITCHARD, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF WASHINGTON

Mr. PRITCHARD. Thank you. I first wanted to say that I think this is a good and proper thing that the Senator is doing. The Senator and I served together in the State legislature for many years.

I do think that this subject is of great importance and that we must have input from outside of Washington, D.C.

One of the problems we have is that we tend to have all the hearings in Washington, D.C. I am not sure that we get an accurate feel of the problems if we don't come to the district. I do have some things this afternoon, and I am going to run out and make a phone call in 45 minutes.

I am delighted that you people are here. I can tell you that we are going to be looking over the record closely because this subject bears on health. It bears on the economics. It bears on a whole variety of issues, particularly in those areas of the country which are growth areas or potential growth areas.

How we handle this, I think, is a pretty good measure of how well America is able to man the technical and difficult social and growth problems of our country.

I appreciate what you are doing here. I will be interested in what you have to say.

Senator GORTON. We will then start with the Puget Sound Air Pollution Control Authority.

Mr. Dammkoehler?

STATEMENTS OF ARTHUR R. DAMMKOEHLER, EXECUTIVE DIRECTOR, PUGET SOUND AIR POLLUTION CONTROL AUTHORITY, SEATTLE, WASH.; MARILYN STANTON, AIR POLLUTION CONTROL AUTHORITY, SPOKANE, WASH.; DR. WILLIAM E. PIERSON, CLINICAL PROFESSOR OF PEDIATRICS, UNIVERSITY OF WASHINGTON SCHOOL OF MEDICINE, SEATTLE, WASH.; JAY VINEYARD, PLANT MANAGER, KAISER ALUMINUM & CHEMICAL CORP., TACOMA, WASH.; DR. JOHN ALLEN, CHIEF, MASON CLINIC, SEATTLE, WASH.; AND JANET CHALUPNIK, WASHINGTON LUNG ASSOCIATION, SEATTLE, WASH.

Mr. DAMMKOEHLER. My name is Arthur R. Dammkoehler. I am representing the Puget Sound Air Pollution Control Agency. In testimony this morning, there was a remark that the science writer from the New York Times made. He commented that understanding atomic energy was as simple as ABC, as compared to getting a hold of air pollution control and air pollution issues. I am also reminded that before the 1970 act, I had an opportunity to attend a hearing in Chicago that Senator Muskie was conducting, similar hearings.

He sat through a morning and a half of very technical-type testimony. There was a group of citizens there from the Hyde Park area. Mrs. Byrne was the chairman of that group. She came out and discussed the problem. She said, "This is my problem. Every day I wash my window sills off and the next day I come back and the emissions from the steel mills and whatnot, and this is what I wipe off."

She held up this face cloth that was black. Senator Muskie was so happy, he jumped over the podium and hugged her and said, "That is the first thing I have understood in 2 days of testimony."

I will quickly summarize my testimony—but our agency operates an air pollution control program in the four counties. We are the agency for long-range air quality planning in the region.

Our board of directors is composed of elected officials from the four-county area.

They have endorsed the Clean Air Act recommendations offered below. The nonattainment areas we have in the region are suspended particulate nonattainments, which are the Wamish area, industrial area, Tacoma Tie Flats or Tacoma area for suspended particles. We also have a large area of hot spots that are nonattainment for carbon monoxide.

We have an ozone nonattainment area that covers the urbanized area from south Pierce County up to the northern part of—the southern part of Skamania County. It doesn't include Snohomish County. We also have a lead problem pertaining to the national ambient lead standard. That is a localized problem around a secondary lead smelt on Harbor Island.

We have developed implementation plans and given this to State and EPA on suspended particulate carbon monoxide, ozone standard requirements and also the lead standards.

So we have worked with the provisions of the act since the first major amendments were adopted in 1970. In our opinion, the act works. Having the force of Federal law behind local attempts to carry out local pollution control attempts and the force of Federal deadlines to impart some urgency and reality into the air quality program has been valuable.

Before the Clean Air Act was passed, individual States had broad authority to control air pollutants and proposals are now being made that this authority be returned to the States.

One of the main reasons for the 1970 Clean Air Act Amendments was that this State control proved largely ineffective. States adopted standards based on inadequate research; deadlines for attainment were not set, and there was no consequences if attainment was not achieved.

Different States held different environmental values; some were frankly sympathetic with polluters because of the economic contribution of large sources, and set their controls so laxly as to encourage shopping by industry for pollution havens.

The 1980 Clean Air Act and the 1977 amendments were passed to give consistenty and uniformity to air pollution control in this country at a level that actually protects public health. State and local officials needed the support of uniform national standards and deadlines to resist pressures to relax controls in order to attract and retain industry.

One of the primary reasons for the advance of relaxing environmental controls is that an undue burden is placed on business and the economy due to the expense of compliance.

As Mayor Royer has stated, the Clean Air Act actually benefits the economy of Puget Sound. Recently, an official of the Seattle/King County's Visitors' Bureau said that if business remains stable—and it is now our largest employer—the visitors' industry would become the No. 1 employer within a few years.

Presently, tourism and convention hosting is an $800 million per year business creating 60,000 jobs in King County. By 1990, it is estimated these totals will rise to around $2.5 billion and 100,000 jobs.

Certainly, the physical surroundings of the Pacific Northwest is one of the reasons often cited by visitors as to why they chose this area to vacation in.

A strong Clean Air Act will help insure that this important aspect of our regional economy continues to prosper. Our specific positions on the act were developed in response to the recommendations of the National Commission on Air Quality which submitted to Congress in March, the results of 2½ years of study of the act.

One of the regions that was part of the study was the Puget Sound region. With some significant exceptions, we generally support the recommendations of the Commission. Many of their proposals would maintain significant provisions of the current act, streamline certain requirements and add important new elements to the law. In particular, we support the following recommendations:

One: economics should not be considered in setting the primary air quality standards. National ambient air quality standards should be maintained as clear goals of those levels of air quality needed to protect public health. Costs should not enter into setting such standards. Economics can be considered through the setting of specific emission limitations and developing implementation programs.

Two: the duplications and delays of State implementation plan approvals should be reduced. Approval of the SIP's has taken upwards of 2 years in some cases, due to unnecessary and prolonged Federal reviews and duplication of State and local publication and public hearing procedures. Alternative administrative procedures could maintain adequate review and public participation without delay.

I think in all cases where we were at a deadline to submit an implementation plan, a particular strategy, our agency and local elected officials met those deadlines, but there was no corresponding deadline on EPA to come back with the recommendations, so in many cases, months went by before we submitted the plan and—before the submitted plan was approved and acceptable.

The third area is an inhalable particulate standard should be decided within 1 year. The question of an air quality standard based on particulate matter in the size range capable of reaching deep into the lungs has gone unanswered for too long.

Delay in the issuance of the size-specific standard has caused a postponement of strategies to meet the total suspended particulate matter standard. Further delay can only lead to continued impacts on public health. Delay also creates uncertainties and planning problems for affected industries who will be expected to meet the standards, and also for the cities and counties who are working on strategies on non-traditional-type dust control methods, as to, really, what standard and what program they should be addressing their energies toward.

Hazardous air pollutants should be controlled to a greater extent. EPA has had authority to bring hazardous pollutants under control but only four such pollutants have had standards set. Action is needed to speed up the listing of hazardous pollutants and development of standards and controls to reduce their impacts.

Control of acid rain should be increased. Precipitation with a pH factor below 5.6 occurs throughout the Nation, and the effects of acid rain on fresh water lakes have recently been demonstrated. The existing provisions of the Clean Air Act do not adequately address these potentially serious problems.

Also, a final area we support is a control plan for indoor air pollution should be developed. The jurisdiction for controlling indoor air pollution in public buildings has not been well-defined. The Clean Air Act is the natural statute for defining this responsibility and addressing this public health issue.

In contrast to the above, certain of the Commission's recommendations would repeal or modify viable requirements of the act, jeopardizing progress to clean air. Contrary to the Commission's suggestions, our agency believes that the following recommendations should not be adopted. The first one is the mandatory attainment dates should not be replaced with 3-year reviews. Attainment dates have forced complete, effective, and timely submittals. Without such deadlines, additional controls would be difficult to mandate.

However, for certain areas and for certain pollutants, an extension beyond the existing deadlines may be needed. However, this should be done through a case-by-case evaluation.

One particular area right now is this whole deadline for suspended particulate in issue. Also, I&M requirements should be retained whether or not vehicle-related air pollution is a problem not just in large cities with significant problems. Inspection and maintenance of vehicle emissions has been found to be the most cost-effective measure.

We support this as a real strategy. Additionally, we do not recommend that the new car emission standards for carbon monoxide should not be relaxed from 3.4 to 7 grams per mile. If this is done, essentially, the burden of reducing carbon monoxide levels to meet ambient standards falls back on to the burden of the cities to develop more stringent transportation controls.

The requirements for application of lowest achievable emission rate in nonattainment areas should not be repealed. Reaching attainment involves reducing emissions. Areas already burdened with poor air quality must be protected from new source emissions.

LAER forces the use of the best controls possible. Repealing LAER could force existing sources to install further controls to accommodate new industrial growth because the less stringently that the new sources are required to control, the more existing sources would have to make up the difference to reach attainment.

Otherwise, economic growth could be limited.

The requirements for lowest attainable emission rate need not delay permitting of new facilities if the program is administered and a clearinghouse is maintained to provide the necessary information.

Fees in lieu of offsets should not be allowed in nonattainment areas toward the clean air standards. Our agency has found that sufficient emission offsets are available to accommodate growth.

Nationwide redesignation of nonattainment status as of December 31, 1981, is unnecessary and unwise. Nonattainment designations should be based on the best available information. The act already allows redesignations for individual areas where new information becomes available. A nationwide redesignation effort would lead to confusion, repetition, and duplication of efforts and should be avoided.

EPA should not be given more "flexibility" for taking civil actions against noncompliant sources. More, not less, Federal enforcement may be needed when State or local authorities are unable to bring sources into compliance. The act's provisions for notices of violation or noncompliance penalties have been the most direct and successful mechanisms to force industry to control sources in violation of air pollution regulations. EPA should pursue all noncompliant companies without discrimination, enforcing rules firmly and consistently.

Further, EPA should not be given greater discretion to impose a more graduated rate of sanctions on areas not making a reasonable effort to submit or implement a clean air State implementation plan. In Washington State's case, the passage in 1979 by the State legislature of an inspection and maintenance law for vehicle emissions was directly influenced by the legislature's consideration of the effect of Federal funding sanctions on the State's economy.

The sanctions in the present Clean Air Act are a powerful weapon and not to be used lightly. However, the historical infrequency of EPA's use of sanctions shows that this power is reluctantly if at all brought to bear and that fears that sanctions will be too readily imposed are unfounded.

Class II and class III areas under the prevention of significant deterioration program, the PSD program, should not be eliminated. The PSD program has a critical goal of keeping areas with good air quality from increases in air pollution over a fixed budget ceiling. That is the key word, the budget ceiling.

We acknowledge that the administration of PSD regulations has been complicated and confusing. One reason for this has been the court challenges and subsequent revisions. The regulations must be simplified.

However, an air pollution budget approach is necessary to insure long-term protections of our clean air resources.

Finally, the Clean Air Act should be reauthorized without major modifications. In summary, our experience with implementing the Clean Air Act has been largely positive. As indicated above, there are areas where we believe that some procedural streamlining may be necessary, but on the whole we find the act's provisions reasonable and workable. Our progress has been directly attributable to the standards, deadlines, and noncompliance sanctions contained in the Clean Air Act.

We urge that the act's reauthorization take place without major modifications.

Senator GORTON. Thank you. We will move on through the panel before we ask questions.

Next will be Marilyn Stanton of the Spokane Air Pollution Control Authority. We would appreciate it if you would limit your comments to about 10 minutes.

STATEMENT OF MARILYN STANTON

Ms. STANTON. May I first say that as you can see with the public comments that I made in Denver, which were updated in this paper of November the 6th, I have a file affidavit with the EPA so that I may speak for the air pollution board. For the past 2 years, I have been chairman. I have just finished. I am now an ordinary member, but I still speak for them at this meeting.

You will notice that I am a member of the American Lung Association, Washington chapter. I do not have an affidavit file for that, so I do not speak for the American Lung Association, nor for Gonzaga University, where I teach as a physiologist.

First of all, I wish I could say, like Mayor Royer, that the Clean Air Act has helped the economy of Spokane. Unfortunately, it hasn't. At the moment, we have taken parking off some of the major avenues in the downtown area in the times when people are coming to and from work. If you are from out of town and you happen to park on one of those streets, you are going to come back to find your car has been towed away and it will cost you anywhere from $40 to $90, if you can find it, because up to this time, there have been five different towing companies towing your car to five different places. This has been creating havoc. The downtown merchants are really just up in arms.

Nevertheless, the Spokane air pollution board, which contains 2 of the three county commissioners and one of the Spokane council people, one from a small town in Deer Park and a former member of the health arm are political animals and we will stick out our neck and we will continue to support the EPA.

I will save time and say that the Spokane board would say amen to everything that came from the Puget Sound group, because we believe we have trouble with particulates and carbon monoxide. We are one of the dustier places in the United States because Palouse County has terrible soil erosion. When wind blows it all comes to Spokane. Coulee City has duststorms. When the wind blows it all comes to Spokane.

We have paved streets and innumerable acres of unpaved parking lots. When the particulates are finally brought to judgment and we have to comply, the air pollution board will grit its teeth, bite its tongue, and do its thing.

What I am saying is we believe in health first, economy second, and that's the way we are going to play the game. Having said that, you are probably aware of the fact that the Spokane Air Pollution Board is not happy with the EPA. The Clean Air Act is one thing; the way it is administered by the EPA is something else.

I am a physiologist. For 10 years I have been a violent environmentalist. I took the EPA's stand whenever there was a hearing of this sort. A year and a half ago, I wanted to show my class in advanced physiology just how the United States sets up money for research in this; for instance, area of carbon monoxide and how things all work together and finally good comes.

I was horrified to find that the 1971 standards were set with 4 experiments that wouldn't hold up in water in an undergraduate course in research. It was finally brought down to one of those 4 experiments, an experiment by Beard and Wertheim that was so bad, they didn't even bother measuring the carboxyhemoglobin in their patients. They estimated it.

This experiment was never replicated. Group after group had tried, but the EPA kept saying, "Well, they haven't refuted it, either."

Finally, in 1979, a group from the Air Force, under Dr. Otto's work, finally just showed that the darned thing didn't hold water.

I have passed to you a section from the EPA. You will find that after my remarks in Denver last October, point by point the EPA started to refute what I said. I think if I may just take the last few minutes to go down the line, you can, at your leisure, read through this situation. Some strange things came back from the EPA.

For instance, on the very first point, I had said the EPA's proposed standard is more stringent than the current OSHA's. EPA came back and said, "Yes, but OSHA doesn't have to take care of people who have cardiovascular problems; women who are pregnant, carrying their fetuses; et cetera."

What they forgot to tell you is that OSHA has a permit of 50 parts per million leading to a carboxyhemoglobin level of way above 7 in a nonsmoker, whereas EPA is saying, "Our sensitive population is one the verge of serious heart damage at 9 parts per million, which only leaves you a carboxyhemoglobin of 1.5.

I am saying, gentlemen, that the work place of America, under OSHA is a controlled condition to see whether what EPA is saying is actually true. Because inside factories there are pregnant women; there are fetuses; there are people who have lung problems and people who have cardiovascular problems.

All through the years, at 50 parts per million, we have had no outcry from people working under OSHA's conditions.

So I think it is perhaps time to take a look, carefully, at some of the things that the EPA has been saying. I pointed out that if the Beard and Wertheim study had been thrown out, as it should have been, because it was not replicated, they would have said the 8-hour carbon monoxide, parts per million probably is between 25 to 35 parts per million and practically no city in the United States except those baddies like Denver and Los Angeles would even have a problem.

What the EPA came back and said was not in any way to refute me. It was merely to point out that a couple of years after they set the standards, some interesting new experiments came out. But 2 years after the fact does not explain the terrible judgment that was used in 1971.

So what we have now is the EPA trying to cover its tracks. It has to, somehow, come up with experimentation. Beard and Wertheim is gone—that will show there is serious problems at very low carbon monoxide levels. What they have is the word of one man, a Dr. Aronow in California in the Veterans' Administration building, a hospital.

One of the things I pointed out is that they tried to slip in another man, a Mr. Anderson, but his work simply will not hold water.

He gave patients 100 parts per million for 4 hours and only got the hemoglobin up to a little over 4 percent. This is not sensible according to the EPA's own Coburn tables.

Well, what happened? The EPA wrote back and said, "Well, I am sorry you made a mistake." You see, Anderson didn't give his carbon monoxide steadily. He gave it intermittently, and that is sheer nonsense. All you have to do is to go read the Anderson article. I have it present if any of the doctors here would like to see it. You will discover that it was not given intermittently.

I am sorry, Senator, I am skipping around a little bit because time is of the essence. I am picking out the high points.

Here we have a case where, frankly, either the EPA can't read or they are deliberately trying to mislead the public. Another thing that I accused the EPA of was using the National Academy of Science document from 1971, which is hopelessly out of date, and forgetting to even quote the 1977 document which was deliberately set up to help them make the 1981 decisions.

I have quotations from that 1977 document that are really devastating. In order to make sure that you understand that I was copying it down right, I actually photostated it and actually underlined, for emphasis, certain areas. You can read them at your leisure.

The difficulty that the Spokane area has is that we do not think the EPA has a way of setting up a truly nonbiased group to take a look at the experimentation. You will also find in the handout that I have given you a set of graphs which, for the first time, I think, pull together all of the experimentation that the EPA has told us about with Aronow and Mr. Anderson. You will discover that over the years, some very interesting things have happened.

The lines on these graphs, inasmuch as they are standing up right, show there is very little damage even to an anginal patient after small amounts of carbon monoxide. If you take a look at the surveys as the years go on, the lines begin to tilt and tilt and tilt until they are almost lying down.

In the 1981 experiment which was the most important one, the EPA commissioned this especially to set national standards. You will find that there is a great discrepancy with the 1971 studies, but presumably, both of these studies used anginal patients, exercised them in more or less the same way. Something is strange.

I would like to close by asking you to look carefully, if you can, at a copy of the 1981 American Heart Journal article that the EPA commissioned Dr. Aronow to do, to cinch keeping the 9 parts per million standard, even though they admit it was a very bad choice way back in 1971.

This article shows that Mr. Aronow, at this point of the game, has had exactly 33 absolutely perfect raw data charts. This simply does not happen in ordinary work, and on the very last page of the data, you will see on the left-hand side the absolutely perfect raw data that Aronow has gotten over the last 10 years.

Contrasted with that is other experimentation with the EPA with Mr. Anderson, Dr. Brinkhaus, and I just went to the library and picked out, off the shelf, just by random, another article involving anginal patients. Once again, you simply do not see this perfect kind of data.

Something is very strange. Also, it turns out that Aronow used patients who were much older in the 1981 experiment, much sicker. The first time he had patients who not only had angine with coronary occlusion but they had a history of myelocardial infarction on top of it. Then, strangely enough, he had them exercise not to pain or angina, but an imaginary world called discomfort. The EPA, when I asked them, "Why is it that Aronow gets data that no one else can," they told me something that I find absolutely unbelievable as a physiologist.

"Aronow trains his patients."

Now, nowhere in the articles does it say anything about this training.

A pre-experiment training of subjects is against all ethics in medicine. The whole thing is very odd. There has not been a truly unbiased looking at the situation.

The reason it is not unbiased—and I will leave you with this—there is a very interesting old boy network going on in Washington. You will discover that different people who sit on different committees actually are lifetime friends of each other, oftentimes coauthors of experiments. We would say, for instance, find Coburn sitting on the National Academy of Science group sitting on the CSAC group; sitting on various other committees.

I don't think we are getting a true look at the situation. The Spokane group, in closing, believes, that the 9 parts per million should and could be changed to 15 parts per million and still be in conformity with well-documented medical work.

Thank you.

Senator GORTON. Thank you very much, Mrs. Stanton.

Dr. Pierson of the University of Washington School of Medicine?

STATEMENT OF WILLIAM E. PIERSON

Dr. PIERSON. Thank you, Mr. Chairman. I am also one of Congressman Pritchard's constituents so it is a pleasure to be able to be before him.

I had no communication which I will align with Marilyn Stanton before we came to this meeting, but certainly her remarks are pertinent to what I would like to say. I would like to confine my remarks—I have given a one-page summary because Jim Davenport told me I had 30 seconds rather than 10 minutes.

Senator GORTON. We will give you a little bit more than 30 seconds.

Dr. PIERSON. Thank you. What I would like to do is to bring some data to your attention which I think you would accept as hard data that has been generated in the Department of Environmental Health with two people there by the name of Dr. June Koenig, a fellow by the name of Dr. Robert Frank, and myself, who have had a chance to do five different studies with sulphur dioxide in children and adolescents, primarily adolescents.

I would add that this work was reviewed by the Human Subjects Review Committee, which is in conformance with the NIH standards for human subject experimentation, and was approved, each of these studies, were approved by that group.

Three of the five studies that I will talk about briefly have been referred and published. The other two, one is in preparation, and one has been submitted, so that this is relatively recent work.

But in a nutshell, there are five studies that I would like to go through. The first one was with asthmatic adolescents which were exposed to 1 part per million of sulfur dioxide for 30 minutes at rest. They had significant changes in their lung function, namely, decrease in both their large and small airway lung function.

The second study, study B, was the same group who were exposed to 1 part per million of sulfur dioxide, but with modest exercise. This we define in a physiological condition as six times resting ventilation, which means basically six times what you would put out to sleep. It is mild exercise. It is walking, basically.

The third study was done on a healthy nonallergic group of adolescents. Thirty ninutes' exposure, 1 part per million of sulfur dioxide also showed significant changes, but they were minuscule when we compared them to the changes in the asthmatic patients in the first two studies.

The number, 8 of 66. We had to screen—this gets to a problem of what do you define as normal, healthy? I am a pediatric allergist. We work very hard to convince our patients and their families that they are normal, healthy people. They just have some problems that require a little medicine. We don't solve their problems by keeping them inside and keeping them off the Olympic teams.

That is not the way we want to approach that problem. There are things that can be done, to find people who are nonallergic by the various lab markers.

We had to screen 66 adolescents to get 8 of them that came out as normal.

We might ask about the population, but the population, as a matter of fact, came from your district.

That means you have some sensitive people in your district. At any means, it is difficult to arrive at criteria. One of the things that she is reacting to is the fact that the most important part of any scientific publication usually is not the abstract or the summary, but it is in methods and materials because no matter how good the data are, if they were done in a shabby way, the conclusion is as weak as the scientific design of that study.

I think this is terribly important when we start to set standards that we base it, you base it, upon the data that is presently available. I think that that is why we want to call this to your attention. So that healthy adolescents did have some changes. They were only much smaller than nonasthmatics.

Study D looked at nonasthmatic allergic adolescents. These are people who had no asthma, but had hay fever or hives or some other kind of allergy.

Interestingly, 30 minutes of 1 part per million showed that they developed significant decrease in their lung capacity when they were exercised for 6 minutes like the asthmatics.

In other words, it was a way to actually foment or implement a form, if you will, of pollution asthma in otherwise nonasthmatic patients.

This, to us, was significant in the sense that our population, which I am going to get to, is much broader than the small, small group.

Finally, we went back and studied. And studied the patients that we had studied in study A at one-half part per million; did the same experiment, random, again, and indeed, the changes were almost identical. So that in turn, we had two points on the does-respond curve and at a half-part per million, 30 minutes of exposure, there was significant bronchial construction, particularly in the large and small areas, that was caused at a half-part per million.

We can extrapolate from these five studies the fact that 15 percent of the population is allergic, which means if there is 70 million people under age 20 in this country, that is a significant number of people at risk. The other, 60 million or so, healthy people, may also, in that 30 minutes' exposure, have some kind of change. This is only 30 minutes, so if we relax our SO_2 standards, we are doing it where we may have many more millions of people on the threshold of some bronchial pulmonary disease than now is appearing.

I think finally, the fact that these studies correlate well with the group from the University of California—I think Dr. Homer Boushey, Mr. Chairman, testified before your group on the 1st of June. His data was done primarily in adults, but basically, our studies, interestingly enough, without exclusion, were done on adolescents because that was the group of patients that we had at our disposal.

But the findings are similar to theirs.

We would like to say, No. 1, that we are very concerned about any relaxation, certainly, and second, we would like to at least have the committee consider the possibility of a need even for a short-term SO_2 standard, for which there is none at the present time. These are studies that are—or have been completed within the last year.

I hope that they can be made part of your deliberation.

Senator Gorton. Thank you. They will be. I find that to be most interesting testimony.

Mr. Vineyard from Kaiser Aluminum?

STATEMENT OF JAY VINEYARD

Mr. Vineyard. Mr. Chairman, I am B. J. Vineyard, manager of the Tacoma Works of the Kaiser Aluminum & Chemical Corp. On behalf of Kaiser Aluminum, I would like to thank you for the opportunity to share our views on the reauthorization of the Clean Air Act. I would like to commend you for giving the citizens of

Washington State a chance to participate in these hearings, right here on our own home ground.

Senator Gorton, Kaiser Aluminum & Chemical Corp. is a major international primary aluminum producer with substantial diversifications into other business lines. We have 75 plants and 20 support facilities in the United States as well as significant operations in 10 other countries.

Our company got its start here in Washington and today we have two major plants in Spokane, our Tacoma Works, and a plant in Vancouver. All told, we provide jobs for about 4,500 Washingtonians and add hundreds of millions of dollars to the State's economy.

At Kaiser we believe that those who talk about gutting the Clean Air Act are wrong. The act has been an important force in improving our environment. A force in insuring that we pass along to future generations a safe and healthy atmosphere.

We also believe, Mr. Chairman that Congress, during this reauthorization process, has a great opportunity to correct the problems that have arisen under the current law. The Congress can make the act a more effective tool in improving our air by rewriting some contradictory and self-defeating provisions.

To illustrate my point, let me discuss a specific case related to our Tacoma plant, located just 30 miles south of here. I think our experience at the Tacoma Works is an excellent example of several unintended effects of the law, effects that not only are counterproductive in terms of improving our air quality, but also counterproductive in meeting other important national goals, like conserving energy and strengthening our economy.

First, Mr. Chairman, I would like to address the act's nonattainment requirements. We can all agree that the goals of the nonattainment provisions are desirable, but their implementation, in all too many cases, has produced a very desirable side effect.

The current provisions actually discourage us from making the kinds of investments that will provide a safer, healthier environment for our workers; develop an aluminum-making process that is 25 percent more energy-efficient; and achieve a significant reduction in the emission of total suspended particulates, or TSP, for which the metropolitan area is in nonattainment.

The problem is this: Our incentive for investing $200 million in a modernization program is increased production. That's basic economics. The improved energy efficiency of our modernization facilities would allow us to boost production. But because of this higher level of production, there w[illegible] an increase in emission of carbon monoxide for which our are[illegible] also designated nonattainment. This increase in carbon monoxide is sufficient to trigger the nonattainment permit requirements under the act.

Senator Gorton, this pres[illegible] with a catch-22 situation: There is no feasible control technology for carbon monoxide in a primary aluminum plant. There also is not an adequate supply of offsets available for carbon monoxide in the Puget Sound area. So we can't meet the nonattainment requirements, and we would be precluded from modernizing our Tacoma Works. Without modernization, we won't be able to achieve the kinds of very important improvements I mentioned earlier in worker conditions, emissions of other substances, or energy efficiency.

Senator, we believe that what we face there is a question of balance. The act in its current form doesn't provide enough room for commonsense solutions in unusual circumstances. Our proposed modernization is beneficial to the community and the environment. But faced with no feasible way to leap one environmental hurdle, we would be precluded from making progress in so many other important ways.

It is ironic that the Tacoma Works does not now, and will not in the future, contribute to the nonattainment condition. But, because of the court decisions in *Alabama Power, et al.* v. *Costle,* the EPA had to eliminate a previously available variance from the nonattainment requirements for such a situation.

Our problem with offsets is not an isolated case. It is typical of what should be expected in nonattainment areas. The reason is that the other requirements for nonattainment, if implemented as directed by the law, actually eliminate offsets.

The act requires that existing sources of the nonattainment pollutant must employ reasonably available control technology to reduce emissions to the greatest feasible extent. Further, the law precludes the use of these legally required reductions in emissions as offsets. Thus, potential reductions in emissions for offsets are available only after all feasible reductions have been made.

It is obvious that further reductions are either unfeasible or so expensive as to be economically impracticable. Furthermore, since RACT will produce very stringent control, there is very little actual reduction of emissions available, even at very high cost.

Kaiser Aluminum suggests that the nonattainment provisions should be amended to allow sources to increase emissions of nonattainment pollutants where it can be demonstrated that such emissions would not interfere with the ultimate attainment of the standards, or where the source does not and will not contribute to the nonattainment condition.

If a source can demonstrate that it is not contributing to a nonattainment condition, or making an existing nonattainment condition any worse, it should be relieved of all nonattainment requirements.

As I mentioned earlier, we operate other plants throughout the country, and we have experienced other difficulties with certain provisions of the act.

As a member of the National Environmental Development Association Clean Air Act Project, NEDA/CAAP, Kaiser Aluminum recommends additional changes in the act. NEDA/CAAP has identified those areas of the act which cause unnecessary costs and delays without real benefit to human health or the environment, and has made specific recommendations for changes to eliminate those problems.

Kaiser Aluminum is providing for the record a copy of the booklet which presents the NEDA/CAAP recommendations for changes. We hope you will consider them.

I wanted to be here today, Senator Gorton, to give you a local perspective on an issue that has been very frustrating. We have committed and proceeding with plans to make an investment of hundreds of millions of dollars that will save energy, reduce pollution and provide a safer, healthier work environment for our workers.

But, we are stuck on one provision of the act, even though we do not and will not contribute to the nonattainment condition. What we need, as this act is reauthorized, as it should and must be, is flexibility and balance, the flexibility to modernize our industries to provide a stable job base in this ever more competitive world, and a sense of balance so catch-22 provisions don't preclude us from achieving the quality of life and environment that we are all here to share.

That concludes my formal statement, Mr. Chairman. I would be pleased to answer any questions you might have.

Senator GORTON. Thank you very much, Mr. Vineyard. Next is Dr. Allen from the Mason Clinic, Seattle. Doctor?

STATEMENT OF JOHN ALLEN

Dr. ALLEN. Thank you, Senator Gorton. My name is John Allen. I am a pulmonary physician in Seattle; a medical professor at the University of Washington's School of Medicine and an environmental health consultant for the Washington Thoracic Society. My testimony today is presented on behalf of the Washington Lung Association and the Washington Thoracic Society.

Both these groups would support reauthorization of the Clean Air Act without significant change. My presentation and that of Janet Chalupnik, who will follow me, will address the nonattainment provisions 171 through 178. This relates to areas which presently exceed the standards and are of great interest to the Lung Association and the Thoracic Society, organizations which are dedicated to the prevention and control of lung disease.

The key features of the blueprint for bringing nonattainment areas into compliance with health-related ambient air standards are the standards themselves; the deadlines for meeting the standards; special provisions for new and existing industrial sources of air pollution in nonattainment areas; and requirements for attaining the standards for carbon monoxide and ozone from automobiles.

My remarks would be directed to the first 2 of these and Mrs. Chalupnik will address the section 2. It is crucial that we retain national standards to serve as a nationwide ceiling on air pollution in order to protect all the population and avoid the possibility that individual States could create havens for pollutions.

It seems clear that much pollution created in a given State will really affect States downwind from that State, and although the State of Washington is in an unusually favorable geographic position, many parts of the country are not so favored. The current standard-setting process, which uses scientific information, as presently constituted with peer review, is an adequate procedure. Setting valid standards will also be difficult. Scientific data is imperfect and we have heard much of that today. The Scientific Advisory Board has provided an unbiased review body and with the increasing emphasis on peer review necessity to utilize material for that review, this really should be the body which determines standards.

We would oppose the Broyhill amendment, shifting authority for standard-setting from the EPA Administrator to a committee with representation from industry and the Chairman of the Council of Economic Advisers. The procedure for determining the level of a pollutant which will protect public health with a margin of safety should remain scientific and independent of cost considerations.

Costs are appropriately taken into account in establishing the programs and timetables to meet the standards.

The ambient air quality standard should continue to be established at levels designed to protect all of the population, including sensitive groups with an adequate margin of safety. Recognizing that there is an uncertainty regarding a threshold level for any pollutant, it is prudent to include a margin of safety in the standards so that if we err, it is on the side of safety.

Other factors which persuade us to continue allowing a margin of safety include our limited knowledge of sensitive individuals and groups and the difficulty of defining healthy individuals, as Dr. Pierson has so clearly pointed out.

The recognized but little understood interactions among pollutants presents a significant problem and the latency period which exists between exposure to pollutant or pollutants and the development of chronic diseases. The idea has been advanced by those who would weaken the act that air pollution causes only minor irritation which is reversible.

However as Dr. Pierson pointed out, an exposure may cause a minor irritation in a healthy person which would cause incapacity or certainly more severe and irreversible effects in sensitive individuals.

In addition to the significant number of asthmatics and asthmatic individuals in our population, there are approximately 15.6 million people suffering from obstructive lung diseases whose condition can be made much worse by air pollution.

Even in Seattle, with reasonably good air quality, it is not uncommon for many of my patients to refuse to come downtown perhaps 2 months out of the year because the air in downtown Seattle makes their breathing enough worse that they will not leave their home.

These individuals in essence become prisoners of society. They can't interact with other individuals. They can't go downtown to shop. They can't do anything but stay in their home and hope that the air gets better. Other sensitive groups include pregnant women, children, elderly, persons with heart disease. These persons deserve protection from air pollution. The suggestion from some industry groups that the standard should be set to protect only the general population from significant risk or irreversible damage would seriously compromise public health protection in this country and certainly would make many of these groups significantly less able to interact in society.

Two improvements with respect to standards are needed: A standard for fine particulates, as has been discussed earlier by several panelists, and a mechanism to accelerate the promulgation and enforcement of standards for hazardous pollutants such as arsenic.

The existing procedures allow a lapse of too much time between the recognition of the hazardous pollutant and the scientific literature and its regulation of the source. Arsenic is an example of local concern because we have the largest release of arsenic in the form of the Asarco copper smelter in Tacoma. Arsenic has been recognized for many years as a major risk factor in the development of lung cancer, but the EPA has not yet developed a standard.

A recent risk assessment for arsenic indicates that between 2 to 40 deaths a year can be attributed to arsenic from the smelter, but so far, no action toward developing the standards has been set forth. Standards have been set for vinyl chloride, but again, the process of developing these standards may be very slow.

As far as fine particulates, many of the comments made by Mrs. Stanton are correct. The difficulty that Mr. Dammkoehler faces, that EPA faces in general with particulates as the standards presently exist is that nice, safe dirty ordinary dirt floating around in the air is measured and taken into account in exactly the same fashion that the same particles made up of chemicals which are very injurious to lung tissue are if inhaled in significant amounts. All of this is accounted on a weight basis only and without regard to whether it is a big plug of dirt that isn't going to get past the nose or a little tiny chemical particular that will get all the way down to the lung.

We do need a standard for fine particulates. Five groups define respiratable particles, fine particles, et cetera, different names, but the basic goal we need is a separate standard for that sized particle which will truly get into the air sacs of the lung and create damage on the basis of chemical injury.

Elimination of the guidelines for meeting standards has been proposed. We are strongly opposed to that. The standards and the deadlines for obtaining them have been largely responsible for the progress which has been made to date in improving air quality despite growth in the sources of air pollution. The program has been impressive and should continue. We fear that it will not continue or will be greatly slowed by the elimination of deadlines.

Target dates and deadlines are at the heart of our planning process. They govern our priorities and influence the selection of programs to be funded.

In summary, the Lung Association and the Thoracic Society support the current nonattainment provisions of the Federal Clean Air Act and oppose weakening amendments such as those sponsored by Representative Broyhill and others. Thank you, sir.

Senator GORTON. As you said, your testimony leaves us with new data, Ms. Chalupnik. We will go to that right now.

STATEMENT OF JANET CHALUPNIK

Ms. CHALUPNIK. Thank you, Senator Gorton.

I would like to begin by saying that you are one of the best informed and best prepared individuals that we have ever testified before. I would like to compliment you on that. Your questions are great.

Senator GORTON. Thank you. You can pass those compliments on to a very good staff.

Ms. CHALUPNIK. Thank you.

I am Janet Chalupnik, representing the Lung Association, American Lung Association in Washington. Dr. Allen has covered our positions regarding the health standards and the deadlines regarding them. I will address the provisions in the Clean Air Act related to stationary and mobile sources of air pollution in nonattainment areas, particularly as they apply to the State of Washington.

First, I wish to reiterate our strong support for the Federal Clean Air Act and our opposition to any major changes in the act.

If we maintain current progress, under the nonattainment provisions, projections indicate that there will be only 8 to 10 air quality regions in the Nation not meeting the standards by 1987. That is in contrast to 156 out of 247 regions that were not meeting these standards in 1975. So that is impressive progress.

I would like to see the State of Washington be among the first to come in to compliance with all the standards. I think we really have a chance to do that. It would be in keeping with the commitment of the people of this State to a clean and healthful environment. If we keep the basic legislation, the standards and carry out the implementation plan, we can have healthful air in Washington before the 1987 lead line. We are fortunate in that way. If we weaken any of the elements of the process, we will continue to jeopardize the health of a significant portion of the population.

The identified nonattainment areas in Washington include, as Art Dammkoehler has said, portions of the Seattle, Tacoma, Spokane, Clarkston, Vancouver, Renton, Kent, Port Angeles, and Longview, in the cases of particulate. I have included those areas outside of Art's region there. Seattle, Tacoma, Spokane, for carbon monoxide, the Seattle-Takoma metropolitan area and Vancouver for ozone; Harbor Island and the freeway corridor in Seattle for lead and sulfur dioxide in Port Angeles and sort of a borderline nonattainment for sulfur dioxide in Tacoma. I say borderline because at one point it was classified as nonattainment and then it was reclassified as attainment.

In Port Angeles, it kind of jumps back and forth between the two classifications, but there is an SO_2 problem. So this means, basically, that all of the heavily populated areas of the State have air pollution problems of one sort or another, and it is imperative that clean air preference continue on schedule. The provisions of the act and the current Washington State implementation plan developed pursuant to those provisions require existing stationary services in nonattainment areas to utilize reasonably available control technology to control their emissions.

This is a key provision which would be eliminated under the—what I have seen as the draft of the administration's proposal for amendments to the act. I just received a copy of that draft a couple of days ago and noticed that the RACT requirement would be eliminated in Washington. The proposal that it be eliminated in areas that could meet the deadlines by 1987, it seems to me that there is no justification for eliminating a requirement that is, by definition, reasonable.

I am talking about reasonably available control technology for existing sources, and I think in the nonattainment area that that is absolutely basic.

Current provisions governing the location of new sources in a nonattainment area require that the area have a plan for coming into compliance and that the new source not interfere with the attainment of standards. In the first place, this is already a compromise in that we are talking about allowing growth in a presently dirty air area, but we go along with this because if the new source will obtain offsets for the pollution that it would add, and if it uses dust fill controlled technology and will not interfere with attainment standards, then fine, we are willing to go along with the growth in presently dirty air areas.

But we cannot compromise those provisions. Otherwise, the air will just keep getting worse in a nonattainment area. If a State is unable to develop a plan for meeting the standards, no new sources are allowed and other sanctions can be applied. I think this is reasonable. These provisions of the act, although they may sound stringent, grow out of the past history of failure to achieve clean air by 1975, which was the original target date, or even by 1982, the current deadline for all pollutants except carbon monoxide and ozone.

The Congress, in 1977, reflecting the wishes of their constituency, wrote these stringent requirements to say, in effect, "This is a serious problem and we mean business."

Somebody else has already referred to the recent Harris Poll conducted on the 6th and 10th, that shows that 80 percent of the people kept the Clean Air Act the way it is or made it even stronger. In light of good public support, it is difficult to understand the proposals for removing the requirements for special sources in an area that has unhealthful air.

Turning to mobile sources in nonattainment areas, we support the current emission standards for new cars and inspections and maintenance for in-use vehicles.

The provisions of the act requiring the IM program in establishing a planning process for transportation control planning worked out very well in the Puget Sound region, where we had an excellent interagency program involving a broad-based citizen's committee.

That committee was composed of members of the chamber of commerce, industries, a council of aging, clean air groups, environmental groups. It was a very broad-based coalition.

We worked out a plan that did include inspection and maintenance. As has been pointed out, that legislation was obtained, and it is going to be the main thing that will give us a reduction in carbon monoxide and ozone and enable us to meet the standards for 1987.

So I would really hate to see the requirement for inspection and maintenance in this kind of an area removed. I think it would really kind of put us in an awkward position here. We can, of course, maintain a State program that isn't mandated by the Federal act, but truly, the Federal act was very persuasive in getting this program in the State of Washington.

We also achieved a set of transportation control measures which will not only improve air quality, but also save energy and provide good mobility for people. There again, the planning provisions of the act, transportation control planning provisions of the act, made all that possible and made it happen.

Turning to section 119 of the act, I want to comment that it is of particular concern to us here in the Puget Sound region, because it provides extensions to 1988 for nonferrous smelters to come into compliance with sulfur dioxide standards. Our group opposed section 119 when it was added to the act in 1977.

I understand that the draft administration proposal would indefinitely postpone the requirement for nonferrous smelters to comply with sulfur dioxide air quality standards. We are, of course, opposed to that on the basis that no whole category of industry should receive a total blanket exemption with no deadline whatsoever. If deadlines cannot be met, then we need a case-by-case review and not a blanket exemption.

A particularly astute student of the Clean Air Act has likened the ambient air quality standards to the life blood of the act and has likened the notation plans to the skeleton which holds it together. I think that is a very good analogy. Both the Broyhill amendment and the draft administration proposals that I have seen would drain some of the life blood from the act and remove key portions of the skeletal structure.

The Lung Association urges you to resist these crippling amendments and keep the act and the air healthy.

Thank you.

Senator GORTON. Thank you.

We thank all of you for your great patience. I would like to have your comments on Marilyn Stanton's specific statements, which I don't believe went to the necessity of the national standards, but were a criticism of the standards for carbon monoxide. Do any of you wish to make any comments on the thrust of the points which she made?

Dr. ALLEN. I would say that I support the remainder of Ms. Stanton's testimony, but perhaps have great difficulty in going along with that particular part, the argument about carbon monoxide standards certainly being lax at least for perhaps a decade.

The problem with carbon monoxide is in great measure stated by Ms. Stanton. It is perhaps the only air pollutant presently controlled whose effect is totally an immediate effect in health terms.

We are enormously concerned about almost all the other pollutants described in terms of blatant effects, long-term effects, cumulative effects. That is not the case with carbon monoxide, whose effect is solely the effect, an immediate effect, of increasing carbon monoxide levels in blood, carbon monoxide levels inside muscle groups and in heart muscle and the effect that those carbon monoxide effects would have on both brain function and heart function.

The arguments, I think, Mrs. Stanton described, I have listened to both sides of that for at least a decade. I am persuaded that our information on carbon monoxide is perhaps the weakest of the supporting data for any present standard, but nonetheless, after listening to it, I think perhaps the present standard is about as close to where it ought to be as we are likely to get it. Perhaps it could be 10 instead of 9, or somewhere in that area, but we do have a margin for safety. We don't have clear evidence of the effect on patients with either some types of heart disease, as well as some effects on brain function, and these—I think the effects probably are more safely controlled at something very close to present level.

Ms. CHALUPNIK. I would just comment that OSHA has been looking at its carbon monoxide standard for a number of years. The thinking is that it is far too lenient. They, in fact, should be revising their standard downward to make it more stringent.

Senator GORTON. There is a heck of a lot of difference right now, though, isn't there?

Ms. CHALUPNIK. There is a difference in all of the standards right now, of course, because of the whole underlying philosophy. I'm not sure I really agree with it, but the philosophy, of course, is in the workplace; the standards are more lenient than they are for the population at large.

As I say, I think that we need to really take a good look at our workplace damage, too. I'm not sure that they are sufficiently protective of the health of workers. After all, people spend a lot of their time at work.

I wouldn't want to try to weaken an ambient air standard based on current OSHA standards, particularly one that is really under Fargus. It was really too lenient for air exposure.

Dr. PIERSON. I think the way I would answer your query is as John alluded to, this is where, really, some effective study and finding a way to effectively study it is one—has been one of the major problems; to get some data to really determine whether or not, at what level, there is real or imagined danger.

I think that this is where the scientific community has got to be urged, with the help of the EPA, to approach this. If it is—if the present study designs are not performed in a manner that adequately answers this question, then I think we should be looking at some other ways to approach the problem.

Senator GORTON. If Ms. Stanton's suggestion of an 8-hour standard of PPM as justified were accepted, would there be any nonattainment areas in the State of Washington?

Dr. PIERSON. I can't say.

Do you know, Janet?

Ms. CHALUPNIK. I can't say offhand, either.

Mr. DAMMKOEHLER. Pretty close.

Dr. ALLEN. Probably not.

Ms. STANTON. If I may reply, Spokane is very close to making it the 12 parts per mil, but because we are in a valley and at the mercy of the weather, there are times when we are likely to go up to 15 percent carboxy hemoglobin depending on the year. Sometimes we luck out. That's why I would say 15 parts is a good bargaining point. Maybe we can come to a compromise at 12. That way we could make it. There is a problem in the carbon monoxide in the EPA that there isn't with the sulfur dioxide. There was an article in "Science" by Dr. Shepard, Tokyo; they had contacted you with money so that you would replicate those studies. They tell me they don't have any money to replicate Dr. Aronow's work. In fact, they have told me, in Denver, that there isn't anybody in the whole United States that can even do this study, which I think is sheer nonsense.

So what we have is evidently two different groups within the EPA, one good one for the SO_2 and one that is a little hard line for the carbon monoxide. Perhaps the good Senator can get something done.

We are not against a good medical survey that will show that we are in danger at three parts per mil. You know, if there is a real medical necessity, we will go with it. Right at the moment, we are dismayed that the EPA doesn't have this data and doesn't seem to be in any great hurry to go get it.

Senator GORTON. Mr. Vinyard, in a sense, was the odd man out on this panel. He was the only one representing an industrial concern.

Dr. PIERSON. That is why we have him in the middle.

Senator GORTON. I would like any of the rest of you to comment on his specific problem and his specific suggestion, the one which we had for Kaiser as to what your views are on that.

Dr. PIERSON. I think that from the standpoint that—this has been said several different ways. I will say it again.

I think that, No. 1, we want to do our best to get at least the current scientific data that is available to establish the standards as phase 1. As phase 2, then, the implementation would be where cost-benefit and his difficulties could be addressed.

But to weaken, if there is available data, to say——

Senator GORTON. I don't think that was it. I want to get more precise on that. It seems to me that what he said was that he was not quarreling with the specific standard.

Dr. PIERSON. I understand.

Senator GORTON. What he was saying was, should there be a mechanism where, if the net overall effect of a proposed change is beneficial, should it be blocked because one element of it does not come within compliance of the present law in the nonattainment area?

Dr. PIERSON. From our standpoint, obviously we would feel very comfortable if it wasn't SO_2, but that is the particular thing that we know about.

I think that that really——

Senator GORTON. In this case, it wasn't.

Dr. PIERSON. I know that. That's why it's easier to have him sit here.

Really, that, at least from a physician's standpoint, I think we have to stay with what we know. That really is more of a policy standpoint where you are going to have to evaluate the relative benefit in risk that your scientist panels, whoever they are going to be, are going to tell you, and that you people will be the ones that will decide ultimately.

Senator GORTON. Perhaps the two on the left got me.

Mr. DAMMKOEHLER. I think the issue he described, at least as I understood the facts within the broad nonattainment area that was originally classified for CO, we have identified a number of hotspots where really, truly, we have violations of the carbon monoxide standard, and the rest, potentially; an attainment area. As we developed our regulations, we identified the hotspot areas and these were the only areas to where one would have to get offsets for carbon monoxide.

If you are in an attainment area, within a nonattainment area, you are all right; however, some Federal cases went forward and the one you mentioned, Alabama Power, sort of confused it further.

So we have been meeting with Kaiser, with the State and citizen groups, or the citizens committee, discussing this issue: how best to resolve it.

A number of issues or ways have been put forth. I have talked to the Department of Ecology just before lunch. I understand they have sent out to EPA a proposal to redesignate our carbon monoxide area in the Puget Sound region. So we are picking up these hotspots and the other areas are going to be attainments.

Essentially, that letter went out yesterday, I understand. I think that is our approach to resolving this problem. It now has to go to EPA, and I guess they will take action on this reclassification issue.

Senator GORTON. I take it you think there should be a degree of flexibility under the act in which you can solve problems like this?

Mr. DAMMKOEHLER. We have solved it under the act. It took a little time. I think it is solved if EPA will buy this.

Mr. VINYARD. Sign here.

Mr. DAMMKOEHLER. We have worked at it for a year. He has proceeded ahead on good faith.

We have worked very well with the State department of ecology and the Puget Sound Department of Ecology.

We have tried to work within the law. They have done the best that they can, and I think we are about to solve it.

Senator GORTON. Let me go on and see how you evaluate some of the other provisions of the act.

Most of the carbon monoxide emissions in Tacoma that would make it nonattainment come from automobiles. If we had in place an inspection and maintenance system, that in and of itself might clear that entire area within the present limitations. Do you have any views on whether or not we should aggressively pursue an I. & M. program?

Mr. VINYARD. I'm not familiar with the numbers there. They are 15 to 9. It would certainly seem that it would go in the right direction, but I have no opinion on that.

Senator GORTON. I cut you off from a comment?

Ms. CHALUPNIK. I was glad to hear Art's explanation, because that was my understanding, too. I think that it is flexible and once their problem was recognized, it caused a reexamination of the boundaries in the SO nonattainment area.

It was found that they actually are in an attainment area. The citizens committee said, "Fine, we don't think things should not happen for some irrational reasons." So the boundaries have been redrawn on a much more monitored basis.

That was my understanding, that it could proceed. The whole citizens committee said, "Fine, we absolutely are against any type of unreasonable bureaucratic snags that keep good things from happening." I thought that was an example of flexibility.

Senator GORTON. Obviously if it is, it took a great deal of time. In a way, you have been able to get to that question which was presented by Mr. Vinyard.

Should the statute, should our reauthorization reflect the fact that this kind of problem comes up more frequently and more explicitly allows for flexibility so these problems can be solved, some of them, more quickly?

I think that was the thrust of Mr. Vinyard's request in his testimony. He may have solved it, but I can hardly imagine that his problem is unique across the United States.

Ms. CHALUPNIK. Can I give another example, then?

Senator GORTON. Sure.

Ms. CHALUPNIK. Suppose it is a suspended particulate nonattainment area? There are offsets available for suspended particulates, and so if you are going to allow a few industries to come into a nonattainment area, then we feel that they should get offsets. To me, it's already a compromise. It's a way to allow growth in a nonattainment area.

If you waive that, well, then, I don't understand why it won't get worse. If it's already bad and you are going to add and you are not going to decrease anywhere else, the arithmetic seems to come out that you are going to have more pollution in a nonattainment area.

For that reason, I think that an offset should be a requirement in a case like that.

Senator GORTON. Mr. Dammkoehler, in your testimony you stated, I think quite properly, that the Puget Sound area has made significant progress toward satisfying the requirements of the Clean Air Act and you were alarmed at the possibility that the requirements would be significantly weakened.

Does that alarm arise out of the fact that you think that if any of these weakening amendments were adopted, there would clearly be backsliding as far as clean air in the Puget Sound area is concerned; or, on the other hand, that while here we might have a high enough consciousness and desire for clean air which State and local agencies would fill in, but that we would then become something of a competitive disadvantage to other parts of the country which wouldn't relax their standards to get business opportunities which would be prohibited to us?

What do you think would happen? Let's take the worst case. Let's take the case that everything that you have seen in Broyhill or the President suggestion took place.

Mr. DAMMKOEHLER. We will lose some time getting reorganized. This is the third time we have gotten together the implementation plan. We have had one in 1970. Then it was reorganized again. We put in another plan. Then we had to do it again, so this is the third plan. I think on carbon monoxide, I think we must have had—I know the State put a plan together; Seattle put a plan together; EPA put a plan together. So this must be the fourth plan.

Senator GORTON. The real problem is every time these things are drastically changed you have to start at ground zero.

Mr. DAMMKOEHLER. Ground zero. And we have to start all over again. I think this is what we are concerned about. We made great progress, and this seems to be a tendency we see that, "Let's go back to the way it was and the approach we used 8 or 9 years ago" has been discounted by testimony in front of Congress is the way it proceeds.

Now we are seeing individuals who testified 8 years ago switched around 180 degrees, saying, "We ought to go back to the State setting ambient standards; States setting control plans and what not."

Again, we see this as a loss of time and possibly this whole issue of attracting industry as it relates to where the lax laws may be.

It is interesting to note in our region, within the last months, the types of industries that have come in here are industries seeking a clean environment. Fairchild went down. I think that was projected to be 3,500 jobs and Packard is struggling to get up in Snohomish County. That is another 3,000 types of jobs of clean industry. We see some other industries looking east of Bellingham and that area.

Senator GORTON. Your region is large enough to have both nonattainment areas and PSD areas and the like.

Have the varying requirements between areas such as that had any effect as far as you are concerned in industrial growth in concentration? Do they derive groups to one place or another?

Mr. DAMMKOEHLER. No; we really haven't seen that. I think the types of industries that are attracted to nonattainment areas, such that we have around the waterways and the harbor areas are there because of a necessity and it would meet all the requirements of the PSD or nonattainment areas that come in.

In fact, one industry went far and above what we considered lowest achievable emission reductions, so they could reduce their emissions so they wouldn't have to obtain offsets. That was a positive effect that they are willing to come and meet these requirements.

Senator GORTON. I should like—all right, I will let you make one more comment.

Ms. STANTON. One more thing. The Spokane group did do a survey. Those funds that they had put in maintenance, they discovered that although it did seem to help the CO level, it never truly cured it. What happened is that the town has the expense of M. & I., but it was still under the gun as far as the EPA was concerned.

Senator GORTON. You think that would be the case in Spokane?

Ms. STANTON. Yes; that's why we decided not to go with M. & I., even though that puts us under the gun. We have to get there by 1982; whereas if you go from maintenance and inspection, you have got until 1987. There is another thing that needs to be said: That is cigarette smoking. Inside pollution is so bad compared to outside pollution that it is ridiculous. One of the things I have to admire Dr. Aronow for doing is that we did confirm European work of Hern showing that in a nonventilated room, a nonsmoker can come up to about 2½ percent carboxy hemoglobin in just 2 hours. But in a well ventilated room, it still is about 23 parts per mil.

That is worse than anything we have ever had in Spokane outside. Here we have an angina patient, often times a confirmed heavy smoker himself, going to a social gathering in a well-ventilated room and raising his hemoglobin above what the danger point is that Dr. Aronow presumably proved in 1981. We have catch 22——

Senator GORTON. Fortunately there have been no ashtrays up here.

Ms. STANTON. Our very first person from Puget Sound pointed out that one of the biggest problems we have is with indoor pollution. Nobody has a handle on this.

Senator GORTON. Thank you all very much.

At this point, we will have time for individual citizens who have signed up to speak to us. I am not sure that all who signed up this morning are here now, but I think for the sake of giving each of them the maximum opportunity, I will call the first four up here and we will work from there.

Eric Swensson; George H. Hess; Adrianna Hess; Nancy Holbrook.

If we may, we would like, because there are quite a number of you, we request that each of you limit his or her testimony to just a very few minutes so that we can hear from a lot of them. Eric?

STATEMENT OF ERIC SWENSSON, CASCADE BICYCLE CLUB, SEATTLE, WASH.

Mr. SWENSSON. I am Eric Swensson. I am representing the Cascade Bicycle Club of Seattle.

Basically, we are concerned to keep the Clean Air Act as strong as possible. We are especially concerned over Congressman Broyhill's introduced legislation, House Resolution 3471, which would call for repealing of section 108, subsection (f), of the Clean Air Act of 1977.

We feel that this would be inappropriate since it would tend to eliminate the ability to monitor programs involving bicycles and bicycling.

We feel that the use of bicycles as a means of transportation, and as an alternative to motor vehicle traffic, has the ability to decrease the amount of pollution by directly decreasing the amount of motor vehicle use.

As noted in the bicycling and air quality information documents published in September 1979 by the Environmental Protection Agency, every bicycle trip that replaces an automobile trip results in cleaner air and gasoline consumption, like auto emissions is disproportionately higher for short urban trips for which bicycle travel can substitute.

Appropriately, we would like to see that provisions involving the Clean Air Act that affect bicycles, mainly motor vehicle portions, not be weakened in any fashion. We feel that since bicycles are traveling with traffic in the roadway system, that they are most vulnerable to motor vehicle emissions and that by the reverse concept, by increasing the number of bicycles, you reduce the amount of emissions that are developed overall.

Senator GORTON. Thank you very, very much. You are George Hess?

Mr. HESS. Yes, thank you, Senator.

STATEMENT OF GEORGE H. HESS, PIERCE COUNTY COUNCIL ON THE AGING

Mr. HESS. I am Dr. George Hess, a retired doctor of medicine residing at 4437 West Grandview Place, Tacoma, Wash. I serve on the advisory board of the Tacoma Pierce County Council on Aging.

The council is a voluntary organization of elderly persons in Pierce County. We publish a monthly newspaper which is sent free to more than 10,000 seniors. We sponsor a bimonthly TV program, "— —'60 MPH,' Making People Happy." This program has an estimated audience of 75,000 persons. We hold public meetings and sponsor activities that affect and involve older people. Such activities touch 90,000 to 100,000 lives each month.

We take an advocacy position on matters which affect the living conditions and health of the elderly.

The air we breathe is a common resource that we all share. Its purity is taken for granted. When industry pollutes our air with unwanted wastes and particulates, they degrade our common heritage.

It is believed that sufficient dilution will render toxic materials harmless. This belief has only partial truth. Long exposure to apparently innocuous concentrations can have a cumulative harmful effect.

The elderly are the segment of the population who live long enough to accumulate the effect of many years of exposure. It is the elderly, therefore, who become incrementally poisoned. Some of us die when there is a smog alert.

With advancing age, people are more susceptible to environmental injury because time robs them of their reserve vital capacity. Years ago, when tuberculosis was prevalent, a patient might lose an entire lung. A young person could compensate for this loss, because he had sufficient capacity left in the remaining lung. An older person has no such excess capacity. When lips are already blue from cyanosis, older people find that even a slight diminution of air quality has a significant effect.

We therefore urge that the clean air laws be strengthened. The growing number of elderly need the protection of the Clean Air Act.

Do you recall President Reagan's physician remarking upon the President's unusual rapid recovery from an assassin's bullet? His rapid recovery is more surprising when one remembers that over half the men born in 1911 are already dead. Pope John Paul's low-grade fever would be considered insignificant except for the fact that he is over 60. Old lungs with emphysema are inefficient at best. They can be further impaired by any degradation of the air they must breathe. Everyone knows that carbon monoxide from automobile exhaust is deadly if confined within an enclosed garage. It is no less harmful when released on city streets. Red blood cells which carry oxygen from our lungs to all body parts have a greater and more lasting affinity for monoxide than they do for oxygen.

Brief exposure to low concentrations of carbon monoxide appear harmless. It may be so for individuals with an excess amount of hemoglobin in their blood. This type of individual is rare among the elderly. They are often anemic.

Additionally, the elderly are usually pedestrians. To climb our hilly streets, they must breathe deeply. They endure long waiting at crosswalks while the motorist idles his car to pour more monoxide into the walled confines of our city. A driver has only brief exposure to the monoxide concentrations he produces. Yet the walking elderly are most susceptible to air contaminants.

Like the canaries which formerly were carried into mines, their good health depends upon pure air.

In conclusion, may I recount a true story? For 15 years before coming to Tacoma, I was on the medical staff of Phelps Dodge Corp. in Arizona. Then many copper miners were afflicted with silicosis which is fibrosis of the lung from breathing dust in the mines. At every session of Arizona Legislature, a silicosis bill was introduced with the aim of dust control and mine ventilation. Every effort was opposed by all mining companies who argued that better ventilation would be too costly and drive them out of business. It was cheaper to fight individual miners' claims in court.

Short-term miners did not make claims because it took 20 years for the disease to appear.

Eventually Phelps Dodge Corp. did modernize mining conditions with dust abatement. Following such improvement, the legislature passed a law written by the Phelps Dodge lawyers. It had high air quality standards with stringent enforcement authorities. The idea was to effect other mines to make extensive improvements.

The expense of improvement was offset by increased productivity by miners. More and better work is performed in a healthy environment.

Senator GORTON. Dr. Hess, Phelps was before us a couple of weeks ago making the same claims.

You are Adrianna Hess? Proceed.

STATEMENT OF ADRIANNA HESS, SAVE OUR UNIVERSITY PLACE

Ms. HESS. Mr. Senator, my name is Adrianna Hess. I live in Tacoma with my husband.

As an individual, for almost 3 years I have served on the Tri-County Pierce, King and Snohomish Citizens Committee, which was spoken about this afternoon. We met right here in this Federal building at least once a month for 2 years, and during the past year we have met less frequently. Thus I learned about many facts, including that in Tacoma we weren't quite as clean as we thought we were.

Also, I came to realize the importance of the Clean Air Act with its national uniform standards and controls. I hope they will be kept and strengthened, if necessary.

However, I speak today on behalf of a citizens group, a nonprofit corporation called Save Our University Place. By its initials, it is popularly known as SOUP. We hope we don't stay in the soup of polluted air.

We started out 3 years ago as a handful of neighbors concerned about the pollution that came from open sewage lagoons in our area. Because of our activities, which have broadened out, with no active membership campaign, we now number about 100 dues-paying members. There are many others interested who come to meetings.

We hold monthly meetings and we mail a newsletter. Our program last year dealt with clean air. Our board of directors, on June 20, 1981, authorized me to appear here today and express our support for the Clean Air Act.

In Tacoma, as you know, we have a smelter that puts out 14 tons of sulfur dioxide per hour. That is over 300 tons per day, over 120,000 tons per year. We look to the Puget Sound Air Pollution Control Agency and clean air legislation to protect us. University Place is some distance from the smelter, but we and our vegetable gardens and our flowers suffer from acid rain. We also need protection from traffic dust since we are in a developing, fast-growing area.

Within our community, we have three gravel pits with activities that affect our lungs. We urge Congress to preserve and strengthen the Clean Air Act.

Thank you.

Senator GORTON. Thank you very much.

Is Nancy Holbrook here now?

[No response.]

Senator GORTON. If not, the next four I would ask to come up would be Grace Easton, Nancy H. Bagley, Jim Smith, and Rex Gerberding.

Again we have three out of four. Grace Easton first.

STATEMENT OF GRACE EASTON, SOUTH PARK COMMUNITY CLUB

Ms. EASTON. Senator Gorton, I am Grace Easton, and I am a member of the South Park Community Club, which is a nonprofit organization; and also I am their chairperson for the Committee on Concerned Citizens of South Park, which reaches out into the full community, not just the membership of the community club.

I also am the representative of the communities north through Snohomish, those that I have heard as having the same problems that we do.

Our neighborhood is regarded as an industrial neighborhood. We are surrounded by industry, and in some places inundated by industry. At the same time, we have an elementary school; a playfield; three churches; and a senior center. We are resentful of the fact that our seniors have had their lives degraded by this pollution.

Many of them suffer from emphysema, bronchitis, asthma, and also many of our young people, not only our children, but our young working people that work in the industry surrounding there. We are angry when we see our children fighting their asthma and their bronchitis, and you see before you today a bronchitis patient right here, now. I would like to say that at any of our community meetings, because it is so bad in our neighborhood, there is no smoking allowed. In my family, I never have smoked. No one has smoked. I have an electronic air cleaner, and I am better off than many people who couldn't afford it. So I am able to exist where a lot of them have much more difficulty than I do.

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Smoking has had an effect. If I get around someone that is smoking, yes, it does bother me terribly. But I also have an effect from breathing the air. We know we are not qualified to know just exactly what is causing our problem. Only we know that we have dirty, dusty, gassy, poisonous air, and that we are not able to breathe like we should be able to breathe. That we know.

We are here, we are pleading with you, that you act and consider the health of the people of the city of Seattle; that you strengthen this act, rather than weaken it. After all, without it, we have nothing.

Thank you.

Senator GORTON. Thank you very much.

Nancy Bagley?

STATEMENT OF NANCY H. BAGLEY, LEAGUE OF WOMEN VOTERS OF WASHINGTON

Ms. BAGLEY. Thank you

My name is Nancy Bagley. I am speaking today for the League of Women Voters of Washington.

Members of the League of Women Voters of Washington would like to share our concern for a strong Clean Air Act. The present act and its amendments have been responsible for significant progress, but much remains to be done.

Specifically, we support the standard setting process designed to protect public health. These standards are a yardstick against which the public can judge the success of polution control programs and the quality of their air. We believe that cost balancing should not be a part of the process for setting primary standards.

Now, costs are taken into account in setting pollution limits for individual polluters and Congress takes costs into account in setting the deadlines for areas to meet primary standards. Cost should not be taken into account in setting the primary standards themselves.

The league is convinced that dirty air areas must continue to be required to meet standards. We support banking and the offset policy as a way of providing for growth while still making progress toward meeting the primary air quality standards.

While some areas cannot meet existing deadlines, this should not be an excuse for abolishing deadlines. Deadlines force action, and they allow the public to judge how programs are working. For those selected areas where deadlines cannot be met, they can be extended. It is important that total emissions be reduced as new growth is allowed.

We also support the present requirements for inspection and maintenance programs, where automobile emissions are a significant problem.

Another concern is the prevention of significant deterioration program, which helps protect the clean air areas.

We support the concept of a pollution budget which underlies the PSD program for the following reasons:

One, it reduces the temptation for industry to move away fron developed areas to avoid control requirements and thus helps prevent economic dislocations; two, it protects against adverse health and environmental effects which may occur even when standards are met; and three, it saves air resources for future growth. Clean air areas cannot be allowed to deteriorate to the air quality levels of our major cities and industrialized zones.

The League of Women Voters supports significant reductions in pollutants which cause acid rain. Acid rain is on the rise in both the United States and Canada, killing the fish in thousands of lakes and streams. Weakly controlled existing powerplants are a major source of acid rain pollutants. Delaying action to reduce acid rain will cause irreversible damage. The effects of acid fallout are cumulative. The longer we wait, the greater will be the damage to our environment.

Thank you.

The League has a recent publication called "Blueprint for Clean Air," which I would like to leave for you and your staff.

Senator **Gorton**. Mr. Gerberding.

STATEMENT OF REX GERBERDING, PORT ANGELES, WASH.

Mr. **Gerberding**. Yes, sir, I am a citizen from Port Angeles. I would like to let you take a look at a couple of pictures while you listen to the presentation. I don't have copies for you. These are pictures generally of the Port Angeles area, where I am a citizen, and I think that they might show some of the complexities of the visibility problem which we discuss in our Clean Air Act.

There are a couple of pictures that show, graphically, Port Angeles on a clear day, and on an overcast day, and on a—let's say a cloudy day with a lot of haze.

I think you can determine the esthetic value between a good day and a bad day. There is hope that this will also help show why some of the PSD merits are so complex. Where the other Senator this morning was wondering about the complexity, there is no model available that can model complex areas like you have in Port Angeles.

Some of these pictures, we hope, depict that. There is a 5 by 7 inch that was taken about 5 miles east of Port Angeles looking out toward Victoria. In the center, there is discoloration due to a plume from Port Angeles. Models would not be able to put the lower limit. You can see an upper and lower limit of the plume. A model would not put a lower limit on that.

This is a concern about the PSD—or the permitting process that I have.

I would recommend that they incorporate a complexity index when they are permitting. In other words, when you are a certain level of complexity in terrain, in atmospherics, where it is known a model cannot handle it, that they be required also to have a minimum of 1 year of monitoring data which an applicant recently really did not have adequate monitoring; also, to back it up with tracer studies and weather balloons. This wouldn't be in every case, but in the West it is more important because of the complexity of the terrain.

There is also one photo in there—I just happened to notice that you were looking at it—of a ship emitting pollution in the harbor. This is one reason why we must have controls and enforcement. The Coast Guard—at this date, this was offloading during the strike this spring. The Coast Guard would be watching all operations. However, this type of emission was going on close to 45 minutes. This is a violation of State law.

The Coast Guard is really not a pollution control authority, and so we do need, a lot of times, Federal studies on this.

I would also like to mention about the aged, which have been mentioned a couple of times already. They do need more protection because you do have more asthmatics and more critical respiratory problems. A lot of the Clean Air Act, I have seen memos to the previous President anyway, talking about the marginal 2 percent of the population. The old age bracket is increasing. It seems like the Government was surprised when all of a sudden there was a big influx in the school after the baby boom. Then they were surprised when there was a big boom in the housing market when they increased to the house-buying age. Let's not get surprised again when this same big bunch of people get old.

Let's not get surprised again. This marginal 2 percent might be the marginal 5 percent or 10 percent. Let's look out for it.

A couple of other recommendations I would have for the Clean Air Act would be that they levy fines. The State fines—which is why sometimes we need Federal aid and a Clean Air Act. The State is more set on local control. States fines are not adequate.

For example, if the northern tier project goes in, that is why I am concerned. One reason about Port Angeles, a sulfur fine or to burn low-sulfur fuel would cost a lot more. To make a fine effective, it has to at least outweigh the cost/benefit of not using it.

Most of the fines on sites are not really detrimental. "Here is 500 bucks. It saves me $5,000; why not pay it?"

I would hope that the new act would have more stringent delineated penalties. I would also hope that the Federal land manager would not have the option to make comments on the PSD for the simple reason, the increments. Let us, for example, say, on the 24-hour class I increment, which is 5 micrograms for SO_2, let us say you have 10 micrograms a day increase for 3 days. There is no way in the world you are going to show damage from this. The PSD is not going to be showing damage. It is to be showing—you are not supposed to have deterioration. If it was damage it would be under the secondary acts.

In my understanding of talking to the people with the parks department when, according to what I have understood was, they were not trying to say that there would not be any damage. They could not prove that there would be any damage, which is a distinctly different thing. I would like to get that clause taken out where they have that option because they—there is a lot of pressure that could be brought into a political body like that.

I would rather have it hard and fast, even if it was changed a little bit.

I would also like to see enforcement of the state enforcement plans, even though they are more stringent than the Federal Government's. The Federal Government has requested State implementation plans. Washington State is more stringent on SO_2 than the Federal Government is. There are grounds for this, which the doctors mentioned, the difficulty with this.

The States get pressure put on them where the enforcement isn't taken care of. For example, in Port Angeles, since about 1974, we have had basic nonattainment level. They finally just started recognizing it with pressure from the EPA.

In fact, in 1978, they had violations of the SO_2 standards which the DOE attributed to a strike. There were several violations in June. They attributed it to a strike from ITT, even though the strike didn't start until July. They didn't enforce it.

Senator GORTON. Thank you very much. These are very good photographs, and most illustrative.

Thank you all.

The next panel will be Homer Frazier, Eloise Kailm, Ed Parents, and Cliff Portman. I see regularly we get three out of four. Homer Frazier?

STATEMENTS OF HOMER FRAZIER, ELOISE KAILM, ED PARENTS, AND CLIFF PORTMAN

Mr. **Frazier**. Senator Gorton and staff, I am Homer Frazier. I am a resident of Sequim in Clallam County. I am speaking for Nola Port. Our interest in the Clean Air Act stems from observation of several permitting processes for oil port sites including two on the Olympic Peninsula.

I am speaking primarily in the area of visibility and to save some time, I can say that almost to the word I would agree with Allan Waggoner's panel, Allan Waggoner's testimony, where he very clearly relates visibility to some economic effects and health effects.

This was to be the concern I was going to try to assure that this was well understood. Esthetics are most important, and I did have some good examples of that. Tying visibility to health effects so closely, as Allan Waggoner did, I am relieved to find out that the National Commission on Air Quality, in their recommendation No. 73, they do propose retention of the current visibility protection program?

In parallel to that, they have a recommendation No. 10, which recognizes the hazard of fine particles to visibility and health. They would require EPA to decide in 1 year on the establishment of a fine particule standard in addition to or instead of the present total suspended particulate standard.

We also can support the visibility and health aspects of particulates found in the National Clean Air Coalition's position paper, a copy of which I understand went to your office. That would be on page 29, they also stress the health hazards of fine particles.

They attribute visual destruction of visibility in the East to fine particules and also the increasing loss of visibility in pristine areas of the West.

There are findings that No. 206 and No. 208 of the National Commission on Air Quality report where they warn that diesels, diesel engines, emit 30 to 100 times the fine particulates of catalyst gas engines and that diesel particulates could reduce visibility by as much as 20 percent in large cities.

Only recently are they really trying to probe the extent of the health problems from these very fine particles.

This brings me close to the only example I will use, the oil port site permit observations: That has to do with one of the applicants estimating that he would have 100 tons per year of particulate emissions from tanker stacks.

Now, if you equate that out into automobiles and take the two-tenths gram emission they are allowed, this would be equivalent to, say, 38,000 more automobiles in the Port Angeles area.

More than that and very recently in the permitting process, and almost concurrent with the new information on diesel automobile engines, it was revealed that many of these ships will be motor ships. They will burn diesel—or they are diesels. Here I can find the problem will be similar on a much larger scale. There will be much larger quantities of particulate emissions from that type of ship.

For that reason, we oppose the Commission's recommendations which relax a definition of major emission sources. That is recommendation No. 57, and we oppose recommendation No. 65, which would propose to increase the diminimus level for particulates from 25 tons up to 100 tons.

One more reaction to the Clean Air Act is we have many times been amazed at the flexibility of the act and sometimes disappointed to lose something that we thought the act was protecting us against. The most recent and outstanding example that we hear is that EPA may give away the control of emissions from tanker stacks.

As far as considering them in their air modelings for new sources, and possibly for actually monitoring, which would place harbors, like Port Angeles in the situation of having tankers with the diesel-type emissions and perhaps no government agency control. We do not feel that the State can really do a good job of controlling foreign shipping, for instance.

If there are loopholes in the Clean Air Act large enough for a harbor full of tankers to pass through, we hope that some of those would be passed.

Senator **GORTON**. Thank you, Dr. Frazier. Mrs. Kailm?

STATEMENT OF ELOISE KAILM

Dr. **KAILM**. I am a physician and board-certified in allergy and immunology. I practiced in Washington, D.C. for 25 years, where I served as chairman of the District of Columbia Medical Society Air Pollution Committee, and I was chairman of the Technical Advisory Committee on Air Pollution for the Metropolitan Council of Governments.

I moved to Washington State in 1971 in part because even on a sunny day, in Washington, D.C.. the skies were gray and depressing from smog. That city had decreased sunlight to the extent of 16 percent over the 50 years of records kept by the Smithsonian Institute.

It is really wonderful to have clean air and see really blue skies over on the Olympic Peninsula where I now live, in Sequim.

In Washington, D.C., it became obvious, something after 1960, that the effects of smog were at least as important as dust, mold, and animal hairs to my patients. Starting in 1963, I started to find patients whose mental function was affected by smog.

Over the next 7 years, I diagnosed approximately 200 persons whose mental confusion, anxiety, fatigue, and headaches were related to smog. Their symptoms were worse on high smog days. They cleared when they left the metropolitan area.

Some escaped by moving away. Most of them lost their jobs. My point for you is that clean air areas must be preserved as a refuge for patients, not only these people who are having cerebral effects, I suspect from the hydrocarbons, which we are not measuring with any degree of accuracy—not only for these people, but for the emphysema and heart patients as well.

Clean air is simply not a luxury. It becomes a necessity for people who are stressed by air pollution.

As a matter of fact, it is not even going to be possible to diagnose what part of mental illness is due to hypersensitivity to smog unless there are clean air areas so people can appreciate that their heads really do clean up when they are in a good area and then they can come back and tell me, "I get lost when I drive in the city here. I can't remember what I set out to do when I go to market, but when I go off on summer vacation and the air is clean in that spot, I can function like I ought to."

Please preserve the PSD aspect of the Clean Air Act. My second point is that the Clean Air Act needs to be strengthened. On the Olympic Peninsula, at Port Angeles, we have for years had excessive SO_2 pollution. Everybody around knows it. It is better now than it has been for years. It was dismissed for a number of years for the reason that the monitoring equipment was substandard.

You knew it was there, but you can't call then on it on the basis of the Clean Air Act because you haven't got the right measurement. Well, they finally got the right measurement and sure enough, we exceeded Federal guidelines.

What happens? We are declared nonattainnent for SO_2? You are kidding. It didn't happen like that. Instead, the EPA Administrator or his staff sat down with the ITT Rainier people. The public was not allowed to sit in on these and they made a deal and they arranged that the air pollution would be decreased by a certain date by whatever their means are.

In spite of that, we are not declared nonattainment, so look what happens next: Northern tier has an application. They do not have to consider our dirty air, and their application will be held as though we were a defector in a compliance area. It is not fair. This is a loophole that should be closed.

I would like to make one additional comment about carbon monoxide and the standards.

I was in Washington, D.C., when the Clean Air Act was first written, and one of the concerns at that time was, "What should the carbon monoxide standards be?" The philosophy of those who were working on this was, "Carbon monoxide is a tattletale of other pollutants that are coming out that we cannot pinpoint." It is something you can measure. There may be other things like the formaldehyde, the benzenes, the benzanthracene that comes along with air pollution from the smog, but you can measure the carbon monoxide and they kind of feel pretty much stuck-wise.

In the laboratory, when you were doing a laboratory study, you were dealing with a single, pure, carbon monoxide thing. You get an entirely different picture if you are using it as the bellwether of other pollutants. I believe it needs to be in there and to remain strict at least until we have a much better scientific handling on all the other complex pollutants that we are not currently measuring.

Senator GORTON. Thank you.

STATEMENT OF ED PARENTS

Mr. PARENTS. Senator, my name is Ed Parents. I am from Spokane. I am representing the Spokane Group of the Sierra Club. You heard from Mrs. Stanton, former city council member and present member of the air pollution control authority in Spokane a little earlier.

One of the things that she didn't state directly is that the Clean Air Act has worked for Spokane. Slowly, but surely, and in some places, ahead of schedule, Spokane is getting a little bit cleaner.

The air is a little bit easier to breathe. If you discount half the pollution flowing by you on any given day, the town looks better, even.

The most recent regional planning conference report shows that our carbon monoxide levels have dropped to where we are experiencing fewer than 30 violation days per year compared to 70 violation days 5 years ago.

It has been faster than we thought it would happen. It is not good that we still violate the 9 parts per million standard 30 times a year, but it is better than we thought we were going to be. We wouldn't be there at all if it weren't for the Clean Air Act.

As far as health standards that we have seen reported in the press—and apparently, the Reagan administration proposal as reported in the Wall Street Journal on the 22d of this month, I don't think it is such a good idea to totally advocate the enforcement of or the methodology of obtaining clean air to the States; that without strong Federal enforcement, strong Federal standards, we are going to see politics being played with the air, which is not what the intent of the act is.

The act may need some tightening up. It may need some modification here. But it certainly doesn't need to be kicked into the political arena where you say, "Let's make a deal. We will give you so much clean air and we will give you so much dirty air."

Idaho shines as an example of this. They have decided since they will have States rights championed by the new administration, they probably will not fund the clean air program this year. They won't put money in to enforce the laws. We need Federal standards. We may need local flexibility, but we certainly need Federal enforcement.

Auto emissions to Spokane are crucial. Our biggest pollution problem is carbon monoxide. We must continue to press the car manufacturers to maintain the emission standards to keep reducing the output of carbon monoxide.

Certainly, it is a technology that is not out of our reach.

There is a great deal of concern in our area regarding the use of coal and the coal strip projects. We have the new Creston project which Washington Water Power is planning and more Creston projects than the one simply plant that they have planned now.

We may see as many as four plants concentrate in one area. We simply cannot afford to have the standards on coal burning weakened. We have nondegradation standards that should be maintained and enforced for that area.

Certainly, we maintain that the technology is well within our hands. One other thing that has raised its head lately is the cost benefit analysis. The only question we have to ask there in determining whether industry can afford to have clean air coming from its factory is, What is the cost of good health?

That is the only question that matters there. Is there a price you can put on good health as to balance it against the cost of cleaning up the air?

Those conclude my remarks.

Senator GORTON. Thank you very much.

The next group is Roger Leed, Mike Ruby, Louis Stewart, and David Isenberg. Mr. Leed is not here I gather. Mr. Ruby?

Mr. RUBY. I could start if you like.

Senator GORTON. All right.

STATEMENT OF MIKE RUBY, SEATTLE, WASH.

Mr. RUBY. My name is Mike Ruby. I reside at 4128 Burke Avenue North, in Seattle. I have long experience in the business of trying to do something about the air pollution in Seattle. I was one of the authors of the first transportation control plan for Seattle, and I have been involved in the rewrites of all the other four that have come since, so I have had some view of this over a period of time.

I want to comment today on the two Republican proposals that I believe would gut the Clean Air Act.

In particular, I am speaking about the Broyhill amendment, H.R. 3741, and the proposals by the administration. I have had a chance to read through the Broyhill amendments, but the administration proposals, I haven't had. I am relying entirely on a summary of them that were released by the House of Representatives' Energy and Commerce Committee on June 18, 1981.

In order to keep my comments brief, I want to direct myself specifically to problems of establishing ambient and emission standards, air quality standards, and in particular, in sections 108 and 112 of the act. In order not to keep you in suspense, I will indicate at the first that my basic conclusion is that I believe there should not be any changes made in these sections.

There are numerous changes suggested. They take various forms. Some of them have been commented on ungratefully but a few other people here this morning and this afternoon, particularly, one section that suggests that there should be some sort of an independent scientific advisory committee to not only look over EPA's shoulder, but perhaps to exercise almost a veto power over the standards adopted by EPA.

The kinds of people that should perhaps be on this independent scientific advisory committee are mentioned to be industry subject to the act, the Chairman of the Council of Economic Advisers, and other people who have substantial scientific competence in problems in effect of air pollution on health.

There is a sort of a hint, a suggestion in all this that the EPA has somehow or another been dishonest in its dealings with the ambient and emission standards. I think that that is really quite an incorrect interpretation of the situation. I think it is really just a question of a difference of perspective.

The people who have been most critical of the standards of various kinds that have been adopted by the EPA most frequently have been the individuals in companies who have been the ones who have had to have been turned around and take some action based on those standards.

The EPA has acted on what might be called a public health perspective, a perspective of protecting the public health; of acting before some grand experiment begins with the public as guinea pigs.

The National Academy of Sciences has frequently been mentioned also as an alternative that might be a forum for some additional points. In fact, they have written a large number of documents in which they have critiqued the same literature as the EPA, basically.

I think there is an important difference to remember between the people who make up the National Academy of Science and the people who should have the proper public health perspective as a public health protecting agency.

First of all, many of the people involved in the National Academy of Sciences' work are themselves scientific researchers. There is a sort of a conflict of interest that develops where it really is quite reasonable to say, "Yes, we should continue research on this field a great deal longer, because we really don't know enough about it."

There really is, among these people, a quite honest, professional attitude of the necessity for proof before we say that we really understand something.

I think, frankly, if we exercise those kinds of standards of proof in England, years ago, instead of the public health officer jerking the handle off the Brighton well, we would probably still have cholera epidemics in London.

If we exercised those kinds of standards in proof, we would have a hard time in saying, "We know what causes babies."

I think it is an important thing to be very careful about exercising these standards of proof that may be quite acceptable in some circumstances, but really are not reasonable when we are talking about protecting the public health.

Rather than changing this protection, the public health emphasis, these amendments, particularly the Broyhill amendment, would institute a rather contentious process of risk assessment, and they would eliminate entirely the concept of the margin of safety requirements that are necessary. Because we really often do not know what it is that is happening.

I think the example that was brought up earlier of the carbon monoxide standards is a perfect example of that.

The comments made on the Beard-Wertheim study was, in fact, a poor study. In fact, the staff of the EPA did, in fact, recommend to John Middleton that a standard of 15 PPM be adopted. However, the director, at the time, of the air branch and several other people associated with the upper levels of EPA decided on the 9 PPM standard because they were concerned.

They expressed a concern that with the Beard-Wertheim studies and similar studies, it indicated a possibility of an effect at a slightly lower level and therefore the requirement of a margin of safety and a desire to be protective of the public health indicated that the standard should be lower.

Time proved they were more right than wrong. As further studies were done, evidence of real health effects were observed at levels lower than those that had been known in 1970.

So their caution and their need to put in the margin of safety was, indeed, appropriate. The other suggestion along these lines was one by the administration, which was that we should simply repeal the secondary standards, that we should not have such a thing. We should give it to the State because after all, it was a welfare and perhaps welfare should be variable from State to State.

After all, some States might have different standards of esthetics or economic damage to crops and this sort of thing. Some States might not care about an agricultural base, while others would. I think this returns us to the good old days of industrial blackmail.

This, I think, illustrates completely the need for uniform national standards; I think uniform national standards with respect to welfare, as well as a respect to health. There are some good cases for some regionalization in some instances, where the standard is based on a particular type of injury to a plant.

There is some evidence that the regionalization can exist, but in most cases, when you look at that evidence, you find that the differences are very small. They are talking about de minimis differences in the standards between regions. Therefore, I think there is some evidence that regionalization exists; is really quite marginal and it would not overweigh the need for uniform national standards.

The other reason that we really shouldn't go to this is the very difficulty that States would have in doing the kind of research that is necessary in order to establish a standard. I think you have probably seen volumes, the rather large documents that EPA produces, and you have seen the mountains of hearing evidence and testimony.

To expect 50 States to go through this process and to go through it with the kind of thoroughness the EPA does, to do the kind of assessments EPA does is not only, I think, imagining that it would happen, but if they did do it, it would be a great waste of economic expense, I believe.

There has been some suggestion also in the Broyhill amendments that even the primary standards might be waived under some circumstances when a project would "provide other environmental or public health benefits."

I don't know quite what those might be, but I have a suspicion that I could conjure them up. I do know that quite frequently, the electric utilities raise the specter that if they are forced to raise their electric bills because of a scrubber, some elderly person might turn down the heat and freeze to death.

I think that that is no laughing matter because it has, in fact, happened on occasion; that people have not been able to afford their heating bills and have suffered greatly for it. I believe this is a perfect example of how one could very easily make that argument and a pliant EPA might very well go along with it and various circumstances.

I would like to comment on many of the suggestions that people have made that we should utilize benefit cost analysis as a way of arriving at the standards. To do this, benefit cost analysis, the thing you really need to do it is a dose response function.

This is something which tells you at a given level of pollution, there will be a certain amount of effect. There will be 18 people who have bronchitis today or something like that. What I find interesting is, the very same people who tell us the EPA studies are not good enough, even though—whether or not a standard should be set, and at what level, which is what they frequently say, "The PA standards aren't good enough"—those are the very same people who are saying, "We should do the benefit cost analysis"; have the dose responses to do these calculations.

If you don't have the data for setting standards, you don't have it for setting benefit cost analysis. All this really is, is a ploy to delay further while more and more studies are done ad nauseam.

Senator GORTON. We have other witnesses.

Mr. RUBY. I will cut this off. Another thing we can say on benefit cost analysis is that it does require a very large number of theoretical assumptions. I think that even a good Eisenhower Republican, if there are any of those left in the Republican Party, might find many of these offensive.

For example, the assumptions are quite individualistic. For example, one is that there is a necessity to assure that all prices are established in a free competitive marketplace where there is no monopoly power, taxes, and all marketers are at equilibrium; no shortages or surpluses. These functions are found so poorly in practice that it makes it very difficult to do the job.

Senator GORTON. Thank you.

Mr. Stewart?

STATEMENT OF LOUIS A. STEWART, WASHINGTON STATE LABOR COUNCIL, SEATTLE, WASH.

Mr. STEWART. Thank you, Senator.

For the record, I am with the Washington State Labor Council, AFL/CIO. I am Lou Stewart. My statement, Senator, will be very brief. We will submit a more detailed statement in the very near future. I understand the record will be open for another 10 days?

Senator GORTON. Yes.

Mr. STEWART. As you are aware, we have been in the job safety business for many, many years. As the incidence of traumatic injury reduced, the incidence of lost time and the incidence of fatalities due to occupational illness, for some reason, started to increase. So for some years now, we have been kind of involved in the matter of occupational health.

I don't know why it took us so long to begin to realize that the same—that the very factors that are causing occupational illness on the work site is causing occupational illness among the families of workers.

The lead that kills the miners over in Idaho, in Bunker Hill, is the same lead that is killing their children in school.

The emissions from a smelter that are killing the workers inside the smelter are the same chemicals that are killing the people in the community. It took us a long time, for some reason, to become aware of that very simple case.

I think you will find that we will be around for a long time. I think you will find that we will be more and more active in this area of cleaning up the air.

If I may, I would like to tell you a very brief story that won't seem to—it doesn't seem to fit in to my written statement.

Five years ago, I had the honor of being a member of a small group of labor people who went to Germany to take a look at the connections between the educational system and the labor movement. I will get back to clean air in a moment. One thing that attracted my attention over there particularly was this matter of codetermination and employee-employer labor relations.

The last day we were there, we were in the office of the general manager of a coal mine. I was up on the site hill looking over Saarbrucken. I asked him, what did he, as an employer think of codetermination where 50 percent of the corporate board is made up of the workers and the representatives. He says, "Instead of telling you in words, let me show you."

Now I am coming back to this hearing. We stepped over to the window and looked down over the city and he said, "Do you see the city down there," the city of 50,000 people, small city, five steel mills running 24 hours a day, 365 days a year.

> The visibility is clear down there. The sky is blue. The reason for that is codetermination. The workers live here and the workers are interested in the community. The owners who were on the boards, they don't live here, and if it weren't for the workers cleaning up these plants, they never would have gotten cleaned up.

That wouldn't fit in my written statement. I just had to tell you about it.

Senator GORTON. Thank you.

Mr. Isenberg?

STATEMENT OF DAVID ISENBERG, SEATTLE, WASH.

Mr. ISENBERG. Again, I appreciate the opportunity to speak and be included in the decisionmaking process. My name is David Isenberg. I am a registered voter in Washington. I am speaking as a chemist and health major, and I am working in the field of monitoring pollutants in the industrial setting, so I feel both comfortable and compelled to speak on this subject.

I also think I have got a fairly different perspective than most. I hope it is a little refreshing after everything that has been said today. First of all, I do not believe that the Clean Air Act should be weakened. If anything, we should get tougher.

There are a number of reasons why industry should not be allowed to pollute, some of these dating back as far as the Declaration of Independence. The Declaration of Independence was issued. Americans were revolting. Why did they revolt? Because they believed in life, liberty, and the pursuit of happiness.

Clearly, air pollution in a nonindustrial environment affects our life. It can outright kill us, especially when certain weather patterns are present when these pollutants are emitted. Let me note in particular some documented episodes where the city air, the air that every person needs to survive, was causing death. Again, this is outside ambient air, not the workplace setting.

London had a killer fog that resulted in 4,000 deaths in that city over a 2-week period. This is 4,000 deaths over what is expected from the normal mortality rates; Donora, Pa., 7,000 sick; 20 dead in a town of about 14,000 in an episode that lasted about 3 or 4 days.

One's liberty is affected—because if one is sick, infirmed or generally not feeling well, then they are not at liberty to fully participate in life.

Pursuit of happiness: Well again, dying and being sick are not particularly happy times. Other pleasures are being cut off. My hobbies include hiking, kayaking, swimming, and fishing. This directly affects pursuit in outside pleasures. Visibility is a problem.

Another problem caused by air pollution is acid rain. Acid rain results in the lowering of the pH of the lake. pH is an indication of the strength of an acid. The lower the number, the higher or stronger the acid. Water which is not an acid has a pH of about 7. Vinegar, more acidic than water, has a pH of about 5, and lakes with bad cases of acid rain have a pH of 4 and lower.

It is understandable why nothing lives in these lakes. How well would your goldfish do if they had to live in vinegar?

After the Declaration of Independence, we had a Constitution. Nowhere in my copy of the Constitution do I see anyone given the right to pollute. However, there are amendments that require due process and just compensation when individuals lose something for the benefit of all.

I do not want to give up my clean air. It is not for sale; nor do I want anyone trying to take it away from me. I would rather pay more money for what I use than to breath bad air. In that way, keeping the threat of pollution can afford to clean up their act. Those that consume the products will pay the real price for them, while those that don't care for these products need not be affected in any way.

In a free market system, the prices are how we allocate resources. By allowing companies to pollute, they have unfair competition over the rest of the country. Their production costs are artificially lowered and the Government, the people are subsidizing them to do that.

Therefore, valuable resources are being used for uses which, under a competitive pricing system, would have the same resources allocated for a different purpose. The people end up bearing the burden for these price supports, yet we do not share in the rewards/profits.

The top 5 percent of Americans by income consume the majority of resources in this country. It is bad enough that we must watch them eat, but you needn't rub our face in it. We should not have to foot their bill. I am not condemning anyone's lifestyle. I am merely asking that people pay the full price for goods and services that they purchase.

Just this month, the Supreme Court ruled that the companies must obey Occupational Safety and Health Administration's, OSHA, NIOSH standards on protecting the employee's health regardless of the cost.

Therefore, if they must protect the people that are working there, the people that have the choice of being exposed or not, then must they not also protect the health of people totally unrelated to that industry? We, the people, do not want pollution. We did not ask for it. We even voted against it, Initiative 381, should we accept out-of-State nuclear waste.

Why must we pay with our lives, our health and our dollars, to clean up someone else's mess? Just as the board of directors in a corporation looks after corporate interests, so too our elected officials should look out for the interests of the American people.

You were elected by us to protect us, not only from outside interests, things outside the country, but also from situations within the country. It is evident by seeing the growth in the Northwest, people migrating to this area, that people in this country do care.

They want to have air that they can breathe and water that they can drink. That is why they are moving here and away from Los Angeles and New York type conditions.

People require a constant source of a quality type of air to survive. Companies do not have to pollute, and, in fact, oftentimes the pollution can be controlled at the source relatively inexpensively, allot more inexpensively than these companies lead us to believe.

We don't always have to make the choice of having a certain product or benefit as opposed to having good air. We can have both.

The Broyhill measures put forth by Congressman Broyhill are totally unacceptable. In conclusion, let me just say that, remember, whatever goes up must come down.

Senator GORTON. Thank you.

I thank the three of you.

Chuck Mathias, Polly Dyer, Marvin Durning and Irene Christy?

FROM THE FLOOR. Irene Christy had to leave but I believe the testimony from the League of Women Voters has been submitted.

Senator GORTON. Thank you.

You may proceed.

STATEMENT OF POLLY DYER, OLYMPIC PARK ASSOCIATES

Ms. DYER. Thank you, Senator Gorton, for holding the hearing in your home State, in your home town, almost. I think it was your home town once upon a time before you went to Olympia.

I am Polly Dyer, president of Olympic Park Associates. The Olympic Park Associates was organized and incorporated in the State of Washington in 1948 as a citizen organization to speak primarily on behalf of the natural and wilderness integrity of Olympic National Park and other areas of the Olympic Peninsula.

For example, in the 1960's we were studying and making recommendations as to what part of the remaining roadless Olympic coast should be added to Olympic National Park, with formal recommendations in 1970 and 1975. At about that time Governor Evans started a Washington State effort to include the remaining 7 roadless miles of roadless coast within Olympic National Park, culminating in the 1976 act of Congress doing so.

An integral part of Olympic National Park is its superb, outstanding scenic vistas, both into the park and beyond, the latter having been reviewed by the National Park Service this morning. We should not, however, lose sight of the require ment to also assure that the air quality affecting the view from points within Olympic National Park is not allowed to deteriorate.

As I am sure you, Senator Gorton, have personal experience, the view from Hurricane Ridge into the central wilderness of forested valleys and mountains is the primary goal for many park visitors.

As a lay visitor myself, I have seen air pollution, obviously from some specific sources that appeared to be pulp mills in Port Angeles, when the plumes wafting up the Elwha Valley on an otherwise clear day did reduce the visibility.

Also with respect to views, the Congress should not ignore that a great deal of viewing is from outside the National Parks and Wildernesses and is from sea level in this State; that is, that of Mount

Rainier and the east face of the Olympic Peaks, the latter being the upper elevations of Olympic National Forest which incidentally are in the administration's approved wilderness for Olympic National Forest. I just also want to point out that you see it. It is of importance to a lot of people. I just brought with me today some needlepoint. A local artist designed this of the east face of the Olympic Park as you see it from Seattle. She also did one of Mount Rainier, and others.

Now that I have it with me, without any thought of using it for this purpose, you might want to get one for your wife or daughter or even if you do needlepoint yourself. Many men do.

In addition to maintaining class I air quality for National Parks and Wilderness, Congress should give high priority not only to the possible loss of air quality but should err on the side of being conservative and direct the National Park Service and other appropriate agencies to conduct scientific research as to potential effects that chemical pollutants in the air can have on the endemic flora and fauna. That does not mean, of course, human fauna are not immune to deleterious health effects.

However, we do not believe sufficient attention is being paid to the problems flora and fauna can have from air pollution if class I areas are allowed to be eroded in quality. From the east coast one hears a great deal about acid rain. As far as we know, acid rain isn't falling in great quantities in the Pacific Northwest yet—and presumably not in Olympic National Park at this time.

That is undoubtedly one of the reasons the United Nations has selected Olympic National Park for the International Biosphere Reserve. Such a designation, incidentally, certainly is a plus for the Pacific Northwest to have an international jewel further recognized for its qualities in addition to scenic beauty.

I might reemphasize the necessity for scientific study for the effects on endemic flora and fauna. However, the potential is there for effects on endemic flora and fauna. The Olympic Park Associates is opposed to any oil port siting on the Olympic Peninsula because of the unknown effects from its air polluting possibilities on the flora and fauna of Olympic National Park and adjacent areas.

We disagree with the recommendations to hold in abeyance protection of vistas from national parks and other class I areas, as was indicated this morning.

Incidentally, this particular paragraph, Mr. Isenberg said far better than I. I was trying to say what he said, but he said it better. Certainly our industrial sector can, if it wants, and in many cases we believe already has, develop the technology to do their jobs right the first time; for example, prevent air quality deterioration at the outset rather than complain after that the fact that it is too expensive to replace earlier installations.

Slash burning, likewise, can be better controlled. I don't think it is necessary to wait until the old growth forest has been liquidated before the forest products industry can improve on fiber utilization now left on the ground. They can remove it rather than leave it there if they wish. Only in those forests—I personally feel that the remaining old forests in this State should have a moratorium outside of logging, even though it is outside of parks, until we take a good look of being—this has been settled a little over a hundred years.

We are really in pioneer stages yet. We have a chance to do better.

In essence, do a better job today when it is more economical to do so in the long run than look only at short-term gains. I think industry can do it.

One of the witnesses this morning indicated that the Federal land managers have the last work about installations that affect air quality within integral vistas. I believe his statement should be corrected. It is my understanding that the Environmental Protection Agency's visibility regulations provide for the Federal land manager to make a visibility analysis on a proposed stationary source's possible impact on the integral vistas to the appropriate agency in the State.

The State then considers this in addition to economic, energy, and other environmental factors when deciding whether or not the State will permit a source that affects visibility. I refer now to Federal Register number, volume 45, No. 233, December 2, 1980, page 80084.

However, within class I areas with PSD permits, the Federal land manager does to an extent have veto power.

Thank you for the opportunity to speak on behalf of Olympic Park Associates. We recommend no diminution be permitted of class I air standards for national parks and wilderness areas, both as they affect visibility looking to the inner parts of these areas as well as to the distant view beyond their boundaries.

Further, it is essential for Congress to take steps to include effects of human-caused chemical air pollution on flora and fauna, as well as humans, within national park units, wildernesses, and similar land categories.

That concludes my formal statement, but I just wanted to make a comment that on Thursday, if you were around, that was one of the spectacular sunny days, almost cloudless days, with the blue skies that we can have around here. We happened to have some guests from California. We went to the top of Mount Constitution.

We had a 360 degree view from Mount Rainier to the coast range in Canada, and of course, all the cascades, glacier peak, et cetera. It was spectacular. Those young people who were coming up here had heard—it had been raining—that they might not see anything. They were just ecstatic to see that view. I think on those days—and you just cannot have air pollution control on sunny days. You have to have air pollution control all the time, so that when the sunny days come, you have those views.

Senator GORTON. Thank you.

Welcome.

STATEMENT OF MARVIN DURNING, SEATTLE, WASH.

Mr. DURNING. Thank you, Senator Gorton. Thank you for giving me the opportunity to speak here today. I do not have a prepared text, but I, first, would like to say that I would like to refer to you personally and to the staff and members of the committee, any assistance I can give from my experience at the EPA about the Clean Air Act; about how it might have been improved or——

Senator GORTON. Put on the record what your background in this respect is.

Mr. DURNING. I served as the Assistant Administrator for Enforcement of the Environment Protection Agency from, really, from late May or June of 1977 until September of 1979, though the first few months, I had not yet been confirmed.

Senator GORTON. Go ahead.

Mr. DURNING. I would like to say I appreciate a chance to discuss many of the issues that are before the Senate about the Air Act, but I believe that I can best help if I limit myself to some perspectives gained from enforcement and implementation.

First, I would like to say that it was my experience that much of the criticism of the act is highly exaggerated, and that much of the fears are exaggerated and overstated, because most of the difficult cases which came to the attention of the Assistant Administrator for Enforcement while I was there were those cases in which it was alleged it was impossible; there was no technology; or the act was unreasonable or it would force a closedown.

It did not force closedowns. In almost all cases technologies were found reasonable; compromises were found.

It is my conviction, after leaving that office, that the Air Act as it is presently constituted is not perfect, but it is a workable bit of legislation when enforced and when enforced with some commonsense in cases which seem to break all reason about that.

I would like to state some statistics which I recall, although I could provide them for you exactly, or the EPA could.

The effort to clean the air of America involves essentially two different types of sources: stationary sources and mobile sources. I would like to put aside for a minute the mobile source problem and think of the stationary sources. I have been trying to number them as a difficult task, but it is estimated that there are approximately 200,000 stationary sources of air pollution subject to the regulatory scheme of the Clean Air Act.

That is, of course, an amazingly high number. It is the State and regional air pollution control agency which deal day-to-day with most of that vast number of stationary sources.

The Environmental Protection Agency and its backup or concurrent enforcement role really is involved with a very small portion of the 200,000. As a matter of policy, it has focused upon what it defines as the major sources of stationary sources of air pollution. Therefore, the universe with which the EPA deals is approximately 25,000 major stationary sources in the United States.

I say that both so that, Senator Gorton, so that you understand that already, the States have primacy in the enforcement of the act, and as a fact, they deal with far larger numbers of stationary sources than the Environmental Protection Agency does. But of course, if you look at it from the point of view of what emits the greatest portion of the pollutants into the air, the overwhelming majority of pollutants by volume would be coming from the 25,000 major stationary sources.

My comments should not be interpreted to mean that the States do not also deal with those, for they do; but the EPA, by and large, because of limited resources, almost never looks at anything but a major stationary source.

In all, some 90 percent or more of the stationary sources—at least of the majors—and I think it is true for all—have taken the steps necessary to build the equipment to bring themselves into compliance for whatever it is that was required of them under their State implementation plan.

I think that is something of a record that the country can be proud of; that—I am using a statistic from approximately 1978. By now I think the number would be higher, still, perhaps approaching 95 percent.

When one thinks about the act and the tremendous effort the country undertook after 1970, you have to recognize that the problems are with a very small percentage of the major stationary sources and that most of American industry is in compliance with the Air Act.

Now second, you would have to recognize that most of the problem is limited into certain industries, industries which are, by nature, more productive of air emissions and perhaps also have simultaneously been suffering economic problems.

In specific, by about 1978, when we were looking into it—and at this point, I would like to record to give me a chance, if I make a mistake, to correct it—but I am sure that those industries in which most of the major stationary sources which were not yet in compliance or flustered were the integrated iron and steel industry, the coal fired electric utilities; chemical and petrochemical industry; the smelters; and maybe pulp and paper, though it is my subjective impression the pulp and paper industry was farther along in compliance than the previously mentioned industries.

Again, this is a perspective that might be helpful, because from 200,000 stationary sources, or 25,000 majors, when you get down to it where we ended up having to bring lawsuits to seek compliance, we only ended up with about 600 to 700 lawsuits.

As a percentage, that is a minute percentage of the major stationary sources of the universe of 200,000, although I should stick to the major stationary, the 25,000, because I don't know how many lawsuits were taken by States that were minor sources.

My point is, I don't think we have a problem with the noncompliance of the Air Act. We have a problem limited to certain problem industries and very large sources in those problem industries. It was my experience and, in fact, I, for better or for worse—I will take it on myself—that I attempted to develop strategies in enforcement which were industry strategies as opposed to worrying about the whole universe.

The first industry to thrust itself upon us was the steel industry which, in the summer of 1977, underwent very difficult times. There were closings in Lackawanna, York, and Youngstown, and many other places.

For the rest of my tenure at the EPA, I probably spent more time negotiating with steel companies than any other single thing. I leave it with a respect both for steelmaking and for the difficulty of the problem, but also with an ability to state to you that less than 10 percent of the major integrated iron and steel mills of America were driven on a compliance schedule in 1977, and when I resigned over 80 percent of the iron and steel integrated mills were on compliance schedules.

By now, that would be a higher percentage scale. I am aware of the legislation which passed both Houses with respect to a further 3 year deadline extension in the event of a modernization plan. I cannot—I might say, it followed exactly the strategy which I developed of tying modernization and deadline extension together. That was the strategy of the steel negotiations.

So I could hardly deny that I think it is a very excellent strategy. It is also one which I think could be extended to other problem industries. The essence is you do first insist on enforcing the law, and then when an industry says: "But we must modernize," you then develop a schedule which works together to go to the goal together of a modernized and cleaned up installation in the same community or area in which the mills are located.

For it is, in many cases, with the iron and steel industry, the utilities, chemicals, petroleum, smelters, it is an industrial location problem. At the same time, it is all the other things. My suggestion is, then, that often the problem is more soluble if you will focus on it in its detail, rather than in the general principles of the whole Air Act or whole giant categories.

The Congress might find a problem with coal-fired utilities, which might have to require some changes in the act, but it might be more successful than the generalizations but for the utilities to, by now, I would guess, they are the largest.

They make up the—that industry—with the highest percentage of noncompliance. They also would be at least one of the largest sources of the remaining pollution in America, large scale.

Most of the coal-fired boilers of America—this may bore our audience, because we have almost none of these in the northwest. We are talking about the problem that extends from Chicago to Buffalo, down to the Middle Atlantic States, over to northern Alabama, and back up to the Midwest, to Chicago, where almost all of the coal-fired boilers and coal-fired utilities of America exist.

There are many hundreds of them. Most of them are out of compliance with the Air Act; many hundreds more on the planning boards. If we are to follow a coal strategy for the electricity and energy generation of America, then it threatens that there will be hundreds and hundreds more of such coal-fired plants.

I think that it would lend itself more easily to solution by a detailed policy toward electricity coal-fired plants than a broad-scaled approach for all industry. It involves you in the trade-offs of energy policy; regional economics; western coal; eastern coal; and some people think western and eastern electrical effects, and so on.

However, it cries out for attention to have a policy. I am sorry to have to say, in my opinion, the Nation has not found anything that is succeeding in cleaning up the coal-fired electric utilities of the country. A minority are in yet compliance. I doubt that there is any great trend toward the rest coming into compliance.

I would just like to give you another fact that might catch your attention of the significance of this toward the acid rain problem more toward the air in the more polluted areas of the country.

I mentioned some industries, steel, utilities, chemicals, petroleum, smelters. If you were to overlay the nonattainment areas of the country, the areas which have not reached the primary standard, with the areas of these large heavy industries, dirty industries, I think you would find a great deal of concurrence.

So the problem would come up again under a different name. Every major integrated iron and steel mill that was out of compliance was in a nonattainment area. I think—although I couldn't scientifically prove it—that it was the reason why the area was in nonattainment.

Now, if you looked at the coal-fired utilities problem, you would be looking at the acid rain problem at the same time.

I would move on to the subject of mobile sources for 1 minute. The perspective which I come away with, that is, that there may be 125 million in the auto and truck fleet of America.

I am not sure. I don't think anyone really knows the exact number, and most of the effort of the Nation was directed toward designing automobiles which, as they come off the production line, would meet certain test standards for their emissions, primarily through the use of various emission control devices.

In the whole history of the Air Act, including today, much less attention has been paid to whether those autos and trucks actually operate during the life that they run around the roads and streets of the country, in the same way as they were when they came off the showrooms.

It is a more difficult task to know how they are operating in the real world as opposed to the manufacturer's line, but it is really the task in which success will be found, because every evidence we had at EPA was that the cars in real use were operating far differently and less well than they had operated when tested on the production line.

So I suggest, again, to the Senate, although I am not sure that legislation is needed, that more focus on the in-use characteristics of the auto fleet, starting with tampering, better repair programs, inspection and maintenance program, do, indeed, perhaps point in the direction of greater gains than further and ever-tightening efforts on the standards of new cars unless you also see to it that the cars, 10,000 miles later and 20,000 miles later, are performing that well. We could be fooling ourselves. You could be also imposing burdens on the auto industry for which you see very real life gains in the cities in America.

The next area to which I would like to——

Senator GORTON. Marvin, I am going to have to make this the last comment, because there are six more people.

Mr. DURNING. I am sorry; I am too interested in this. I won't even go into that. I will say that a big issue relates to the economic burdens placed upon American industry to achieve the goals of the Air Act.

Again, I think it would be more useful to look at some industries where there are significant burdens and recognize that the burdens that have been minor or trivial are most of the industries of America, and that those industries which are most noisy about the economic burdens, ask yourself whether the auto industry really would have been in any different situation had it not had to have emission control devices; whether the U.S. iron and steel industry would have really been any more prosperous had the EPA not been trying to get it and, as a matter of fact, didn't achieve very much until recent years in getting it to clean up.

I think the story will be that the environmental regulations are much disliked by some of those industries, and they make a lot of noise about them, but environmental regulations are not the source of the distresses of the steel industry or of the auto industry.

There is no distress in the chemical petroleum industry, as well.

I would just leave it at that.

Senator GORTON. Thank you.

We will give a minute or so, each, to the very last who signed up: V. Crane Wright, Estella B. Leopold, Warren Warfield, Anne R. Conn, Tom E. Eagling, and Karen M. Fant. Are any or all of them here?

STATEMENT OF ANNE R. CONN, SEATTLE, WASH.

Senator GORTON. Miss Conn, you can start. Please limit as much as you can.

Ms. CONN. My name is Anne Conn. I reside in the city of Seattle, Wash. I am to speak just for myself today. I am addressing my remarks to conditions outside of Washington State because your act will have national implications. I have relatives unfortunate enough to live in Denver.

When there is discussion of not relating air quality standards to health, for me, you are talking about my sister and mother and nephews being able to live in Denver and not deteriorate their health. Right now, my sister can't jog. The kids can't play outside on many summer days because the air pollution is bad.

I think in setting national health standards that people such as these should count; that they should not be defined simply as affecting only those who are healthy. By definition, when you get sick, you don't count and therefore you are not protecting much health.

In regard to significant deterioration, Secretary Volt wasn't the only one born in Wyoming. I was born in Teton Park and my family has been integral in the health systems in Wyoming for a long time.

My uncle is in charge of family health planning for the State of Wyoming. They consider their clean air a vast resource. I believe it is, economically, if you look at the value to the State, to the parks and the suburb visibility that they have. That visibility, it seems to me, is integral to the park.

If you can't see a mountain, you might as well not be there. You certainly don't need to set it aside with Federal money for people that can't see it.

Second, in considering the effect of industries that would benefit from reduced regulations of air emissions, I think it would be wise to look at the water resources those industries should require.

I have many relatives involved in ranching. They are not nearly as enthusiastic about the well development now when it became apparent that the industries wanted water from the Grand River. They are very alarmed. They think they are going to go right into court and secure their water rights.

They are in for a terrible shock. It is worthwhile to consider water in looking at air regulations and consider what sort of growth you are talking about in those areas for the total economy and the economy as it is presently structured.

Also, if there are coal-fired generator plants in Wyoming, it would seem to me their acid rain ought to be looked at. We talk as if the State's air didn't go anywhere. That is a politically convenient construct, but, in fact, air moves all over the place. One must look at the effect of the air in Wyoming when it gets further down.

Thank you for the opportunity to testify.

Senator **Gorton**. Thank you.

Mr. Eagling?

STATEMENT OF TOM E. EAGLING, LOCAL 110 ICWU PRESIDENT, SHELTON, WASH.

Mr. **Eagling**. Thank you, Senator Gorton.

I am president of local 110 of the International Chemical Workers Union and also a member of the Monitoring Committee. I represent local 110, four chemical plants located in the Tide Flats area in Tacoma.

The Clean Air Act has been and will continue to be an ally to all chemical workers. While we work in a hazardous industry, we have learned that our management strives to meet the aspects of the Clean Air Act, and all of us, as chemical workers, have learned what it is like to work in a healthier atmosphere.

Because of the act, we feel that our jobs are now safer and healthier, and we certainly are opposed to any weakening of the Clean Air Act.

Thank you.

Senator **Gorton**. Thank you very much.

Miss Fant?

STATEMENT OF KAREN M. FANT, WASHINGTON WILDERNESS COALITION

Ms. **Fant**. Senator Gorton, I am Karen Fant, codirector of the Washington Wilderness Coalition. The Washington Wilderness Coalition is an association of approximately 20 organizations and 400 individuals, representing about 15,000 people who care about the wilderness and wildlife resources of Washington State.

For years, the West has enjoyed the image of being the land of the wide-open spaces, where the "air is so pure, the zephyrs so free, the breeze is so balmy and light." Yet, even in this land of countless mountains to climb, where one expects to be able to see forever from the summits, the culprit air pollution is taking its toll.

Regional haze, particulate matter, and discolored layers of pollution often obscure or mar the magnificent scenic vistas for which Washington State is known. Visitors travel from all over the country to enjoy the scenery in the West. How often are they disappointed by impaired visibility? To protect the scenic qualities of the West, the visibility requirements of the Clean Air Act must be retained and strengthened.

A second factor of air pollution, acid rain, is starting to have an impact in Washington, also. A University of Washington study has shown that lakes in the Alpine Lakes Wilderness Area are being affected by acid rain.

We urge Congress to require reductions of acid-forming pollutants before the lakes and rivers of the Northwest are no longer capable of producing fish, as has happened in a number of lakes in the East and has threatened to wipe out fish in tens of thousands of additional lakes and streams in the United States and Canada.

Finally, we urge that the prevention of significant deterioration program be retained. The PSD program is important to keep the air above Washington's wilderness areas and national parks as pristine and pure as Congress originally intended for class I areas.

The Clean Air Act is the cornerstone of our national air pollution control program. During the last decade, great strides have been made in reducing air pollution in this country. But more progress needs to be made.

The Washington Wilderness Coalition urges Congress to work toward strengthening the act which protects the resource we all share: the air.

Thank you very much for this opportunity to comment.

I have one additional statement, one question. In the Thursday Seattle Post Intelligence you may have seen the article written by Joel Connelly. He mentioned something about that the Clean Air Act, it wasn't going to be possible to have a big air polluting plant in the Puget Sound region.

Senator GORTON. This is the last of the witnesses. We will keep the record open for 10 days for people to make comments. They can mail them to me either here at the Seattle office or directly to the Committee on Environment and Public Works, Washington, D.C.

With that, the meeting is adjourned. My thanks to all of you who have participated.

[Whereupon, at 5:10 p.m., the hearing was concluded.]

[Statements submitted for the record follow:]

TESTIMONY BEFORE THE SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

MAYOR CHARLES ROYER

JUNE 27, 1981

Mr. Chairman and Members of the Committee, I am Mayor Charles Royer of Seattle. We are very grateful that the Committee is meeting today in our city, rather than in Washington, D.C., so that people here have the chance to participate in your deliberations on an issue of great importance to all of us: the Federal Clean Air Act. The air over our Puget Sound region is not nearly as clean as we would like it to be--or as the law prescribes. We are intensely concerned about the fate of the legislation that offers our best hope of getting air pollution here under control.

Some of the basic ingredients of cities--people, businesses, and vehicles--are also our primary sources of air pollution. Air pollution problems center in the cities, and so cities must be part of the solution. Thank you for this chance to testify on behalf of the City of Seattle.

Any discussion of the future of the Clean Air Act should begin with a look at its past. In 1970, when the substance of the present Act was written, we were proud of the technological know-how that had just placed a man on the moon. We were beginning to recognize the limits of our environment to absorb our wastes. We felt a growing awareness that public health care meant more than doctors and hospitals, and that a polluted environment can make us sick.

I recall vivid pictures of thick, brown smog in Los Angeles, and people with handerchiefs over their faces. Public outrage wrote the Clean Air Act of 1970.

And it's significant that public outrage wrote a national Clean Air Act. Air pollution did not then, and does not now, respect local, state, or even international boundaries. People recognized, too, that inconsistent regulations among states would almost certainly create "pollution havens" in some areas and drive industry out of others. For the automobile, a major contributor to air pollution all around the country, there was a choice between national emission standards at the factory and a multitude of different standards set by state and local governments.

Once air pollution was recognized as a national problem, the next logical step was to sort out federal, state, and local responsibilities for solving it. The Clean Air Act provided nationally consistent ambient air quality standards to be set by the federal government. State and local governments were given some latitude in devising plans to meet the standards.

The Clean Air Act, modified but not substantially altered by the 1977 amendments, has been in place for eleven years now--long enough for us to evaluate its successes and failures.

I do not want to convey the impression that the Clean Air Act is perfect. Far from it. The Act is cumbersome and terribly complex, especially in the process for implementation plans. But these problems can be solved by streamlining and simplifying, not by forsaking the basic structure of the legislation.

I believe the framework of intergovernmental cooperation written into the Clean Air Act offers one of our best models for solving national problems. I also believe the Puget Sound region gives your committee a good example of how the Clean Air Act can work--and why it must work. We have effective relationships among local, state, and federal officials.

More important, we have people living here who, as a number of public opinion surveys show, want clean air and are willing to pay a reasonable price to achieve it. And most important, our air is still dirty--and we need a Clean Air Act operating in full force to support our efforts to clean it up.

Congress should be commended for creating the National Commission on Air Quality which undertook the ambitious task of reviewing the Clean Air Act. For the most part, the Commission's report favors retaining the basic tenets of the Act. Later today you will hear testimony from the Puget Sound Air Pollution Control Authority listing specific points of agreement and disagreement with the Commission's report. As a member of that agency's Board of Directors, I concur with those comments, and urge you to give them careful consideration.

But right now, I would like to take issue with three of the National Commission recommendations which affect cities. These recommendations deal with new car emission standards, inspection and maintenance standards, and the need for deadlines and sanctions.

I was disappointed to see that the National Commission recommended relaxation of some new car emission standards. Because new cars are marketed nationally, new car emission standards are clearly a federal responsibility. Once the pollutants leave the tailpipe, it is impossible for local government to regulate them away. Unless the federal government holds firm on stringent new car standards, cities like Seattle will be stuck with trying to meet federal clean air standards and deadlines with one arm figuratively tied behind our backs.

Most new cars already meet the tailpipe standard that the Commission proposes to relax. There is no more cost-effective means of controlling air pollution than limiting emissions at the factory. Even if relaxing the emission standards helps hold down new car prices slightly, we will all pay the savings back again and again in poor health and unlivable cities. The economic health of the automobile industry need not be inconsistent with the physical health of human beings. The new car emission standards should not be rolled back.

The National Commission has also recommended that inspection and maintenance of automobile pollution control devices be required only in larger cities like Seattle, and that federal sanctions be relaxed. But inspection and maintenance programs serve the same important purpose as the new car standards: controlling at the source the emissions that foul our air. It keeps boiling down to this: the simplest way to stay clean is by avoiding dirt. I have argued that setting tough factory standards must still be a federal responsibility. I argue now that upholding those standards for the cars actually driving around our streets and highways must still be a federally-mandated local responsibility--and it should not be relaxed. Without inspection and maintenance, cities would have to resort to much less cost-effective and more controversial measures to meet clean air standards.

We have a job which we're required to do--which we want to do--and which the law gives us the proper tools to do. The law should not now take away or blunt those tools.

As you know, Seattle is plagued with all-too-frequent violations of the federal carbon monoxide standard. Seattle received an extension until 1987 to meet the standard, provided that we establish an inspection and maintenance program. We accepted this responsibility, despite the costs and burdens it will place on commuters in and around Seattle.

A delicate coalition of business, government, and environmental interests secured the enabling authority from our legislature to conduct an inspection and maintenance program.

Which brings me to my third point. Our coaliton was held together, in part, because of the threat of federal sanctions on highway and sewer constuction funds. It appears to me that the threat of sanctions has served an important purpose.

So have legislative deadlines for attainment of standards. The National Commission's recommendation is to eliminate deadlines and substitute attainment reviews every three years. Seattle and other jurisdictions took the deadlines seriously, both because the deadlines were in the law and because attaining standards as soon as possible made sense to us. Elimination of the deadlines would be a breach of faith with those cities and states which made conscientious efforts to meet the deadlines and reward those which delayed, hoping for legislative relief. Government can have no credibility if deadlines are set but then changed or removed for the convenience of those who do not comply. Statutory deadlines have been an important part of the Clean Air Act, and they should not be abandoned except under very special circumstances; the deadline to meet the urban particulate standards might be one such exception.

We must not forget that protection of public health is the major goal of the Clean Air Act. However, aesthetic considerations are important, too. Today's hearing will specifically address the visibility regulations. One of the major industries in our region is tourism. Tourists come to this part of the country to enjoy our scenic beauties. It would be a shame if our visitors arrived at Paradise Valley or Hurricane Ridge--and found themselves unable to see the view. We support the concept of reasonable visibility protection in national parks and other scenic areas.

A related issue is protecting areas which now have clean air from the fate of some cities. Seattle is considering investing in a coal-burning energy facility to be built in an area which now meets air quality standards. We have no desire to export our pollution problem to this area, and we believe requirements for prevention of significant deterioration should remain in the Clean Air Act.

There is no question that clean air costs money. As our economic situation tightens, there may be a temptation to defer pollution control costs toward the future. This is false economy. We would pay the price for deferring pollution control expenditures with increased future costs for health care. Any significant backsliding in our national clean air commitment would be an abandonment of the elderly and those with respiratory diseases whom the Act was designed to protect.

We keep hearing Americans want the role of our federal government redefined. But if the rumors and press reports about the Administration's Clean Air Act proposals are true, then those proposals go far beyond mere role definition. In fact, the Administration proposals would gut the Act. Normally, we applaud moving control from the federal level to the local level. In this case, however, the proposals we have heard are simply an abdication of federal responsibility.

Mr. Chairman, Committee members, I urge you to defend the substance of the Clean Air Act while you remove some of the complexity and burdensome requirements. It is a difficult job, but one that can and must be accomplished.

Thank you again for inviting me to testify.

STATEMENT OF DR. ALAN P. WAGGONER, DEPARTMENT OF CIVIL ENGINEERING, UNIVERSITY OF WASHINGTON

In the Eastern United States hazes rich in sulfate commonly degrade visibility below 10 miles during Summer and constitute a hazard to aircraft operations Degraded visual range is better understood probably than any other aspect of air pollution.

EPA has taken a staged approach to regulating visibility choosing to limit the presence of visible plumes as the first step for several reasons, including visual impacts of plumes in the Four Corners area of New Mexico was very important to those writing the 1977 Amendments; and also plumes can usually be traced to a specific source, avoiding any question as to the source impacting visual air quality.

A series of plume model validation tests have been conducted during the past 4 years and this work is largely complete needing perhaps 1 additional year to complete the data analaysis and reporting of results. In the test location, clean Northern Arizonia near a major facility model calculations agreed fairly well with measurements of visual impacts. Only the gas NO_2 was important within 100 km of the generating facility in terms of plume appearance. The regional haze appeared to be smog transported with little alteration except dilution from population centers in Central and Southern California. This is one of many indications that the regional haze is an important problem that must be addressed to protect visual air quality, even in remote clean regions.

I will return to regional haze, but first I would like to discuss another problem both with the way the amendment was written and the way EPA implements its provisions. The amendment and the implementation required protection of visual range, the prevention of visual discoloration, and from the intrusion of visibly detectable plumbs into or viewed from class I areas. EPA has devoted much effort to defining what is visibility and why is a plume discernable. No answer is yet obvious and perhaps is is now time for Congress to more precisely define visual air quality. Photographic simulation technicques of the type I have demonstrated here can accurately produce the appearance of various levels of degraded visual air quality. The same type of test suggests that a spatially uniform haze degrades the visitor experience and if the haze is dark and has a definite upper edge, especially, the haze generates health worries in the public. As previously described, the haze can also interfere with aircraft operation, testing and long range photography needed to test weapon systems. Our ability to model optical effects of uniform haze is even better than our ability to model plume optics. We have only limited ability to model the chemistry that creates the haze we are in the early stages of creating a model to decribe transport over the scales of this problem in the East. Research in this area is clearly required as there appears to be a need for regulations and we need to develop and test models for chemistry and transport on the scale of regional haze.

The need to regulate regional haze comes from only visibility impacts but also health risks degraded visual range is caused by particles smaller than 2.5 microns and these same sized particles are retained in the lung and are acid and are generally more chemically reactive. From a source indentification and regulation standpoint, ambient particle samples for air quality regulatory purposes should be collected by size as larger, or course and smaller, or fine with the division at 2.5 microns. A paper by Waggoner and Weiss shows that there is a very high correlation betweeen the fine particles smaller than 2.5. microns and an optical measure of the degree of air quality dergradation of local air. EPA in the Draft Criteria Document for SO_2 and Particles External Draft No. 2 reviews the epidemiological literature. This review appears not to be able to justify from existing data either a 2.5 or 15 micron inhalable particle standard.

I personally feel that three size resolved particle standards are useful. 2.5 micron and below reduces visual impact and is directly related health risk. 15 micron or ten micron below limits particle concentration in size ranges that have created respiratory problems in industrial exposure situations.

There is another relationship between visual air quality and health risk I wish to mention. Nearly all of the pre 1969 health effects studies and a large fraction of the more recent studies have used a measure of the darkness of a spot of particles sampled on a filter aerosol particle collection to determine particle concentration. We now know that this dark sport is due to soot an that soot causes 15 to 40 percent of visibility reduction in urban areas.

Society is now making changes such as wood stoves and increased diesel auto engines utilization that will increase soot emission, degrade visual air quality and increase ambient concentrations of material that has a historical link to degraded health.

In response to specific questions of Mr. Davenport of your staff, I will comment on the degree of pollutant limitation to protect vistas.

In clean areas, there is always some visual haze because the air molecules have some optical extinction due to scattering. Increases in extinction by particles above this will degrade visual range and degrade appearance at all distances above a few kilometers. Based on measurement of fine particle mass and scattering extinction, degraded visual air quality takes place in clean areas at 3 to 5 micrograms per cubic meter of fine particle mass. For areas with preexisting fine particle mass a change.

Mr. Davenport also asked me to comment on integral vista and I can think of nothing more profound than to say I advocate the concept. For those National Parks that have as part of their value views extending outside the park boundary, their view must be protected to preserve the value of the visitor experience.

In closing, I have one last comment. We at the University of Washington have conducted research in visual air quality for more than 15 years. I have been a research scientist in the program for 10 years. This stability has made possible our contribution in this field. Changes in research funding to decrease support available, increase uncertainty, and reduce period of research programs would make our accomplishments much unlikely under current conditions. There is now an instability that decreases useful scientific research at a time when we are ignorant in areas that will require action.

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TESTIMONY OF JOHN S. LARSEN, VICE-PRESIDENT FOR REGULATORY AFFAIRS, WEYERHAEUSER COMPANY

TACOMA, WASHINGTON

before the

SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

Regarding the Visibility Protection Provisions of the
CLEAN AIR ACT

June 26, 1981

On behalf of the American Paper Institute
and the National Forest Products Association

Good morning, I am Jack Larsen, Vice-President for Weyerhaeuser Company. I very much appreciate the opportunity to testify before this committee on a matter which is not only of utmost importance to my company and the forest products industry, but to the public who will have to ultimately pay a high price for what in my judgement is poor public policy.

I am testifying today on behalf of the American Paper Institute and the National Forest Products Association. My testimony will be limited to the visibility protection provisions of the Clean Air Act, and will concentrate on only two issues: (1) the concept of integral vistas, and (2) the selection of areas for visibility protection.

The American Paper Institute and the National Forest Products Association are national associations of the forest products industry representing over 2,000 member companies who own and manage forest lands and manufacture pulp, paper, lumber and other solid wood products.

The two issues, integral vistas and selection of areas for protection, will require substantial and costly alterations in both our industry's manufacturing facilities and timberland management practices...alterations we don't think are necessary, or were intended by Congress. I am here today, therefore, seeking some modification of the visibility portion of this Act as it's currently being interpreted and proposed for implementation.

In the 1977 Amendments, Congress established a program to protect visibility in certain pristine national parks and wilderness areas where it was determined that visibility was an important value. After a two-year process of rulemaking, final regulations entitled "Visibility Protection for Federal Class I Areas," were published by the Administrator of EPA on December 2, 1980 (45 Fed. Reg. 80084, et seq.).

Both the American Paper Institute and National Forest Products Association filed extensive written comments on August 22, 1980. We also testified on this subject in July, 1980 before an EPA panel chaired by then Assistant Administrator David Hawkins. Prior to that, we testified on the advance notice of proposed rulemaking in Seattle, Washington and Salem, Oregon in January 1980. We also filed written comments on the advance proposal in December, 1979. In addition, a large number of individual member companies and other associated groups voiced their concerns about the adverse effects of the proposals.

In spite of this effort, we did not get the modifications we thought were justified. The basis for our request then ---and the basis for our appeal today---is that there is no specific language in the Clean Air Act giving the EPA authority for much of what they've proposed in their visibility regulations. It's their position, as we understand it, that there was an implied intent on the part of Congress to institute such provisions. We can, however, find no basis for this in the legislative records and so, I am before you today seeking congressional clarification of these two issues.

Integral Vistas

The first issue involves what EPA refers to as "Integral Vistas". Under the visibility section of the Clean Air Act, EPA has asserted authority to regulate emissions that may impair the visibility of "integral vistas" which are defined as the views from land marks or panoramas looking out from points within certain national parks and wilderness areas. By this action, the EPA has gone far beyond what I believe most people would conceed is a legitimate purpose...that of protecting visibility within the boundaries of our most scenic public lands. Instead, the Agency is attempting to place millions of acres of non-federal, state and private lands under these regulations. Such regulations will only duplicate other air regulatory programs established by this same statute, which are intended to assure that Congressional goals for air quality protection are fully met.

Compounding the confusion caused by this duplication is the fact that this proposed program also gives federal land managers (i.e. the Departments of the Interior and Agriculture) the authority to decide what views are to be protected as "integral vistas," thereby asserting a Federal authority over private and state lands. Again, I can find no basis in either the statute or its legislative history to suggest that Congress meant to do more than protect vistas "within" our most scenic Federal areas.

Although EPA's authority to regulate "integral vistas" was a key issue in the rulemaking, neither EPA nor any involved federal land management agency actually defined the concept in its actual application prior to final adoption of the rules. We were therefore surprised to find that the concept of protecting integral vistas would extend outward, well beyond the boundaries of federal land. It was not until several months after adoption of the visibility regulations, that we learned just how far the authority of Federal Land Managers would extend beyond Class I areas.

Let me show you how extensive this would be in Western Washingt

This map (see first appended map in written testimony), shows th three National Parks impacting Western Washington. The overlays I'm about to show you, illustrate the National Park Service's pr posed regulations and are taken directly from their descriptions in the regulations.

This overlay, (the second appended map in the written testimony) gives one example, Tolme Lookout, which is a viewpoint proposed b the Federal Land Manager in Mt. Rainier National Park. The heavy blue lines (green in written testimony) encompass the angle of view. The shaded portion is the vista to be protected. The lighter blue lines (green in written testimony) indicate other specific vistas of importance. In this case the specific vistas are Mt. St. Helens, to the South and Mt. Baker and Glacier Peak to the North.

The second overlay (the third appended map in written testimony) adds two more viewpoints proposed by the North Cascades National Park's Manager. Again, the heavy lines indicate the angle of view and the shaded area the vista to be protected.

The third overlay (the fourth appended map in written testimony), shows all the vistas proposed by the three National Parks which effect Western Washington. You will note there is one additional viewpoint in Mt. Rainier National Park; two additional in the North Cascade's National Park; and one additional in the Olympic National Park.

This map is somewhat confusing, but it does vividly illustrate the extensive coverage of Western Washington by the Park Service proposals.

Nearly half of Western Washington is covered. But more importantly, nearly all of the populated, industrialized area, as shown by the shaded areas on this final overlay, is covered. What this means is that any new industries within the shaded portion of this map that have air emissions are subject to review by the Federal Land Manager. The Federal Manager has the power to deny approval of new industry and the power to require more restrictive controls for existing industry within these areas.

You will note the overlap that occurs between integral vistas from viewpoints from these three parks. In many instances, all three Federal Land Managers would be involved in the same decision making process.

In addition, these maps only consider the proposals from the three National Parks. They do not consider the implications of U. S. Forest Service proposals for viewpoints from wilderness areas and National Forests.

We believe these are simply inappropriate responsibilities for Federal Land Managers. These visibility provisions, as presently constituted, are badly conceived, sure to create costly regulatory duplication and confusing for both industry and the public.

Selection of Areas for Visibility Protection

The second issue I would like to briefly address concerns the selection of areas for visibility protection. In our opinion, EPA and the Department of the Interior failed to adequately address a key threshhold question which Congress assigned them in 1977. The statute requires the Federal Agencies to make an in-depth determination as to which of the nation's National Parks, national forests, wilderness areas and other mandatory Class I Federal areas warrant special visibility protection. Our review of the Interior Department's files indicates that the initial selection of areas to be classified within National Parks was done with little or no individual study or assessment. The result was a finding by this agency that our of 158 mandatory Class I areas, 156 of them required visibility protection. Some of these areas it seems to us, just do not meet a reasonable test as to whether they are areas requiring additional protection in order to preserve the view of the scenery within them. At the very least, a more definitive study is needed before making the selections.

Taken together, EPA's asserted authority to regulate "integral vistas" outside of the Federal boundaries, and the designation to date for special protection of virtually all Class I areas being given consideration, expands the visibility protection program far beyond what we believe the Congress carefully contemplated and intended in 1977.

I urge you to give careful consideration to the implication of having this program implemented as proposed. In doing so, I believe you will share our conclusion that these portions of the visibility program are not in the public interest.

In my opening remarks I indicated that I would concentrate my testimony on only two issues: (1) the concept of integral vistas and (2) the process for selection of areas for visibility protection. I also indicated that my purpose in being here today is to seek congressional clarification of these two issues.

In my judgement this can be accomplished by either of two approaches: (1) the first would be for this committee to make more specific the legislative record on the two issues during its deliberations and to follow this up with a letter to the administrator clarifying your intent; (2) the second approach would be to amend Section 169A of the Clean Air Act so as to make more specific the intent of Congress in the Statute. I leave it to the wisdom of this committee to decide what approach would be the most appropriate; however, I hope you will give the matter your serious attention.

Statement

of

William A. Kucharski
Senior Environmental Engineer
Pacific Power & Light Company

Representing

Pacific Power & Light Company, and
Western Energy Supply & Transmission (WEST) Associates

Regarding

The Visibility Protection Provisions of the 1977 Clean Air Act Amendments

Before the

Committee for the Environment
and Public Works of the U. S. Senate
June 27, 1981
Seattle, Washington

TESTIMONY ON CLEAN AIR ACT

Mr. Chairman, Senator Gorton, thank you for giving Pacific Power & Light Company (Pacific) this opportunity to present its perceptions of the Clean Air Act and the effects the Act has on the electric utility industry in the state and the nation.

My name is William Kucharski and I am the senior Environmental Engineer for Pacific. Together with Puget Sound Power and Light and Washington Water Power, I would like to present our views on the impacts that specific portions of the Clean Air Act have or will have on our present and future operations within Washington State.

I would also like to present the views of Western Energy Supply & Transmission (WEST) Associates on regional aspects of the Act. Founded in 1964, WEST Associates is a research and planning group of 21 electric utilities in the West and Southwest. WEST member utilities include all sectors of the electric utility industry - investor-owned, publicly owned and rural electric cooperative. Member companies service a population of approximately 18.8 million in the states of Washington, Oregon, Idaho, Arizona, California, Colorado, Nevada, New Mexico, West Texas and Wyoming.

Let me state at the outset that the air quality in Washington and Oregon is of great concern to our company. Pacific serves over 1.2 million customers in Washington and Oregon (approximately 20% of the population). The electric power load for this service area, as of 1980, was approximately 1720 average megawatts (MW) and between 1980 and 1990 an increase of 43% , or an additional 750 average MW, is projected for these two states alone. The decade of the seventies produced an increase in Pacific's service population in these two states of 23%. By 1990, the population serviced by Pacific in this two-state area is expected to increase an additional 19%. This growth will be accommodated by applying modern conservation techniques, utilizing renewable resources and by constructing new coal-fired generating facilities in the Northwest.

Pacific is part owner and operator of the Centralia Power Plant, a 1330 MW coal-fired electric generating facility located approximately 72 kilometers west-southwest of Mt. Rainier. The owners of Centralia, which include Puget Sound Power and Light Company and Washington Water Power Company, have real concerns over the impact of the 1977 Amendments of the Clean Air Act on the operation of this facility. It should be pointed out that Centralia is the largest coal-fired power plant in the state of Washington (and Oregon).

We believe, Mr. Chairman, that certain modifications to the Clean Air Act would be beneficial both to the people of Washington and to Pacific. We believe the Act, as amended in 1977, places costs on our customers here and elsewhere that are unnecessary in the maintenance of adequate air quality, that it can constrain sensible economic development, and that it actually inhibits improvements in air quality in many parts of the country.

While a great many changes in the Act have been proposed and may well be desirable, I would like to focus on two primary issues that are of particular interest to Pacific.

I. PREVENTION OF SIGNIFICANT DETERIORATION

First, we believe the Prevention of Significant Deterioration, or "PSD", program should be revised substantially.

As you know, several air quality standards are established under the Clean Air Act. The most important of these are the "primary" and "secondary" National Ambient Air Quality Standards which are designed to protect the health and general welfare of citizens throughout the country. In addition to these standards, New Source Performance Standards (NSPS) mandate certain emission limitations at new facilities as well as those undergoing major modification.

The PSD program was established to protect air quality values beyond those sought in conjunction with national standard-setting. To achieve this objective, the program established three classes of allowable emission impacts and in effect established a third set of standards, which vary from area to area, to control incremental air pollution in each airshed.

PSD permit requirements apply an additional "preconstruction review" to new industrial projects or major modifications of existing projects which emit pollutants in excess of a set amount. To determine whether a new project will violate increment limitations, air quality must be monitored and projected impacts must be modeled. Both activities are expensive and modeling, in particular, can and does produce uncertain results.

Modeling is designed to project the manner in which an estimated quantity of pollution is likely to be dispersed from a given location. Since projections are a function of the relationship between such factors as fluctuating meteorological conditions, topography, pollutant release rates and the like, and the true relationships of these variables is not well established, projections differ widely. The PSD program also requires projection and measurement of pollution increments over periods of time as brief as three and 24 hours. In the case of particulates, the relationships between the modeling variables are even less precisely known, and the results, therefore, are more uncertain than for gaseous pollutants.

These PSD procedures impose significant costs on utilities and their customers. Recently, for example, Pacific spent approximately $200,000 on preparation of a PSD permit application for the addition of a coal-fired generating facility at Wyodak, Wyoming, even though modeled pollution levels from the facility were below the level the Environmental Protection Agency defines as "significant". As part of our application, and in order to satisfy the letter of the law, we were directed by the State Air Quality Division to conduct short-term modeling even though state and federal agency officials advised us no adequate modeling techniques exist. Furthermore, the structure of current regulations is such that they would require Pacific to duplicate the entire process should we attempt to build an identical facility at an adjacent site. The calculations would be the same; the impact would be the same; yet the permitting process would have to be repeated, including new monitoring.

Pacific Power believes correction of these procedural problems can produce significant savings for the Company and its customers at virtually no cost to the environment. Specifically, we would recommend that Congress:

a. drop the short-term (3- and 24-hour) increments as they are applied in the context of the PSD program and limit PSD increments to an annual average (while short-term measurement may be necessary to protect health, it is unsuitable for determining significant deterioration);

b. streamline procedures so that permit and review requirements are expedited for new facilities which essentially duplicate existing ones; and

c. carefully review the recommendation of others that Class II and III be eliminated. (With which we agree).

II. VISIBILITY

Our second concern, Mr. Chairman, is the set of visibility regulations adopted recently by EPA. Speaking for Pacific and its two sister utilities, I will state that we are deeply concerned about how EPA has construed Section 169A of the Act to protect what it calls "integral vistas" from Federal Class I areas. The situation here in Washington is an excellent example of the problems facing the utility industry as a result of the EPA interpretation (or misinterpretation) of congressional intent in regard to visibility protection.

Washington has three mandatory Class I areas where visibility is deemed an important value and where integral vistas have been identified. These are Mount Rainier National Park, Olympic National Park and the North Cascades National Park. These parks consist of approximately 2,550 square miles (over 1.6 million acres). The entire state of Washington consists of over 65,000 square miles, so that these Class I areas comprise approximately 4% of the total state area. I reference the committee to Exhibit 1, a map of the state of Washington, on which is superimposed the Class I areas and the areas impacted by the Integral Vista concept. These integral vistas from 2,550 square miles of National Park can be seen to impact over 30,000 square miles of the state.

Nationwide, those National Park Service Class I areas that have Integral Vistas associated with them total approximately 20,000 square miles (only 3,400 are east of the Mississippi) and the integral vistas concept influences, it is estimated, over 550,000 square miles. The impact of integral vistas on the State of Washington graphically illustrates the immense influence the 1977 amendments of the Clean Air Act can have on this nation.

Let me turn now to the broader aspects of the Clean Air Act, specifically the impact of the visibility rules to the Western United States. I am Pacific's representative on the WEST Air Quality Task Force, and I can state unequivocally that we have devoted many months to studying the effects of the Clean Air Act on the energy and economic development in the West. There are really three considerations involved in this topic: energy, environment and economics. Balancing these "three e's" is the fundamental public policy challenge in the Clean Air Act.

The issue of visibility protection in federal areas - such as national parks and wilderness areas - or how far and clearly one can see distant vistas is just one issue in the clean air debate where the "e's" clearly collide. Sections 165, 169, and 169A of the 1977 Clean Air Act Amendments lay out a strategy to protect visibility. Regulations promulgated by EPA in December 1980 seek to execute that strategy.

WEST believes that the objective of visibility protection is an important one - one that must continue to be addressed in the Western Region - but that the strategies designed to meet the objective urgently need to be revised to reflect a realistic balance among the three "e's", especially in the West.

The threshold concern, however, is the matter of the scientific and technical foundation of visibility strategies. The question here is: will they work?

There is serious doubt whether current visibility strategies will yield demonstrable and definite air quality or esthetic benefits. A major reason is that EPA's visibility rules lack a sound, well-developed scientific and technical foundation. Understanding of the causes and sources of visibility impairment still is in its infancy. How to measure and define visibility impairment still is essentially unresolved, as is how to predict future visibility impairment.

In fact, the development of reliable and accurate computer models with which to make sound visibility predictions as part of new source reviews is not yet in place and will probably require several years of further work.

Given basic uncertainties in visibility modeling, monitoring and control strategies, WEST maintains that development of effective visibility protection strategies is not feasible at this time.

Quite apart from scientific uncertainties and gaps, new research studies strongly indicate two major errors in key assumptions in the visibility sections of the 1977 Amendments and EPA's visibility rules: first, that particulates, sulfure dioxide and nitrogen oxides from power plants are primary culprits in the visibility impairment phenomenon; and second, that retrofitting extensive control equipment on power plants and imposing additional siting limitations would solve the problem.

The preliminary results of two very recent studies seem to confirm that these assumptions are erroneous. Early results from a WEST-sponsored state-of-the-art study at the University of Utah indicate that a key component in the visibility impairment theory used in EPA's visibility rules overpredicts by 14 percent the role of power plants and other man-made facilities in the visibility phenomenon, while underpredicting by 59 percent the role of natural factors, such as soil dust in the semi-arid West.

A second study of actual air quality in the vicinity of the Navajo Generating Station in Northern Arizona during 1979-1980 also contradicts basic visibility assumptions. Called VISTTA, "Visibility Impairment due to Sulfur Transport and Transformation in the Atmosphere", this $3 million joint study by EPA and Salt River Project (a WEST member utility) found, at least in the vicinity of the Navajo Plant:

- that the contribution by power plants to regional visibility impairment is negligible compared to forest fires, smelters, urban plumes and other man-caused and natural factors:
- that sulfate particles from power plants in the Southwest do not contribute to visibility impairment as much as particles primarily formed in and transported from the Los Angeles Basin; and
- that the coloration of power plant plumes is a function of the amount of nitrogen dioxide present, nor sulfur dioxide or sulfate particles as is erroneously assumed in present visibility strategies.

Although nitrogen dioxide appears to be the major problem in causing discoloration of power plant plumes, visibility strategies now call for the retrofit of additional sulfur dioxide removal systems. At the same time, EPA acknowledges there is no demonstrable technology presently available to control nitrogen oxide emissions from stationary sources.

The implications from both studies are that present visibility strategies aimed at power plants are not likely to work; that siting limitations and retrofit requirements may well not produce the environmental benefits desired.

These same visibility strategies, however, will have severe and unintended energy and economic consequences in the West. A brief discussion of some of these consequences may help place the visibility issue into a public policy perspective.

First, there are potential consequences concerning electric power. Western utilities will have to meet virtually doubled electric power demand in the mid-to-late 1990s. The region continues to experience high population growth - in the past 10 years the overall population growth rate for the Western region of the country has been 18 percent. The Washington-Oregon growth rate during this same period was 23 percent. The Washington-Oregon load of WEST members has increased by 52 percent since 1970 and by 1990 another 43 percent increase in load is projected. Of the electric generating capacity that is to be added to meet 1989 peak load demand in the Western region of the country, coal is expected to provide a substantial portion. Visibility requirements threaten the ability of utilities to meet this increase in capacity, to the extent that siting restrictions preclude building of needed plants.

As an additional energy consequence, access to and use of the region's energy resources could be severely limited because of the presumed effects on visibility of mining, energy development and resource recovery activities. Impacted between now and 1990, for example, could be an estimated 530 to 660 million tons of coal to be produced in the West;

900,000 to 1.8 million barrels of oil daily from synthetic fuels production; and 1.5 million barrels of conventional oil per day.[1] But the precise effects of visibility strategies on energy development still need to be accurately determined.

Next, there are economic consequences. WEST projects that just the requirements for backfitting additional emissions equipment on power plants could cost the customer of WEST member utilities up to $3 billion, if WEST coal-fired plants were retrofitted to meet EPA requirements. This is almost double the approximately $1.75 billion expended to date by WEST utilities for all emissions control equipment.

Just the capital costs of retrofitting the Navajo Station, for example, are projected to be around $600 million - the original cost of building the plant itself. Yet, there is substantial questions whether retrofitting emissions controls here or elsewhere would lead to improved visibility.

The visibility strategies seem to add yet another layer of costs onto skyrocketing energy prices - costs that weigh especially heavily on people who can ill afford them. Consumers will ultimately pay, in the form of higher energy bills, the costs required to comply with any visibility program - whether scientifically founded or not.

Finally, there is the growth factor to consider in the overall equation. Federal government estimates have indicated that the West can expect some 3 million people to move into the region during the 1980s.

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[1] Based on figures from the U.S. Department of Energy and the Western Governor's Policy Office.

To accomodate these new residents, direct societal mitigation programs will be required, including:

- new elementary and secondary classrooms and new high schools;
- approximately 400,00 additional dwelling units;
- additional hospital beds;
- new roads and railroad grade separations; and
- additional water treatment plants, municipal, commercial and private office space and many other needs.

The ability to meet the energy demands of this growth will be affected by any constraints caused by premature and unscientific visibility strategies. The schools, hospitals, homes, municipal plants, offices and commercial businesses to be established - and powered - cannot and should not automatically be considered secondary to the ability to see distant vistas. This is particularly true since the role, if any, of energy development in the visibility impairment phenomenon is still undetermined.

WEST believes that esthetic strategies developed in the '70s should be reviewed to see if they reflect the changed energy and economic circumstances of the '80s. Now is the time for energy, environment and economics to come together.

Towards this end, WEST offers the following recommendations for visibility strategies. Addressing the scientific uncertainties associated with visibility, the recommendation is designed to maintain scenic beauty and other esthetic values in national parks and wilderness areas, while allowing progress toward the equally critical goal of energy and resource development.

In summary, recommended refinements to Sections 165, 169 and 169A of the 1977 Clean Air Act Amendments would:

1. Require that visibility protection strategies be based on a 15-year program of progress, with the first five years set aside for a scientific study to be reviewed by Congress before further legislation and/or regulation regarding visibility is undertaken;
2. Recognize and continue, in the five-year scientific study, the visibility research now underway by industry and government;
3. Identify, in the five-year study, the natural and man-made factors in (and relative contributions to) visibility impairment and develop validated computer models to predict contributions of each;
4. Delete visibility as a siting review criterion for new sources given scientific uncertainties;
5. Require that any future decisions which might require additional emissions control equipment on major stationary sources be based on clear criteria including cost, energy consumption, remaining life of the plant, plus any benefits to be achieved; and
6. Delete the concept of "buffer zones" or "integral vistas" around certain areas by limiting the applicability of any future visibility protection activities only to those areas within the boundaries of Mandatory class I Federal Areas.

WEST stands ready to work with government toward the stated goal of reasonable progress in visibility protection.

That concludes the prepared statement, and I would be pleased to answer any questions you might have.

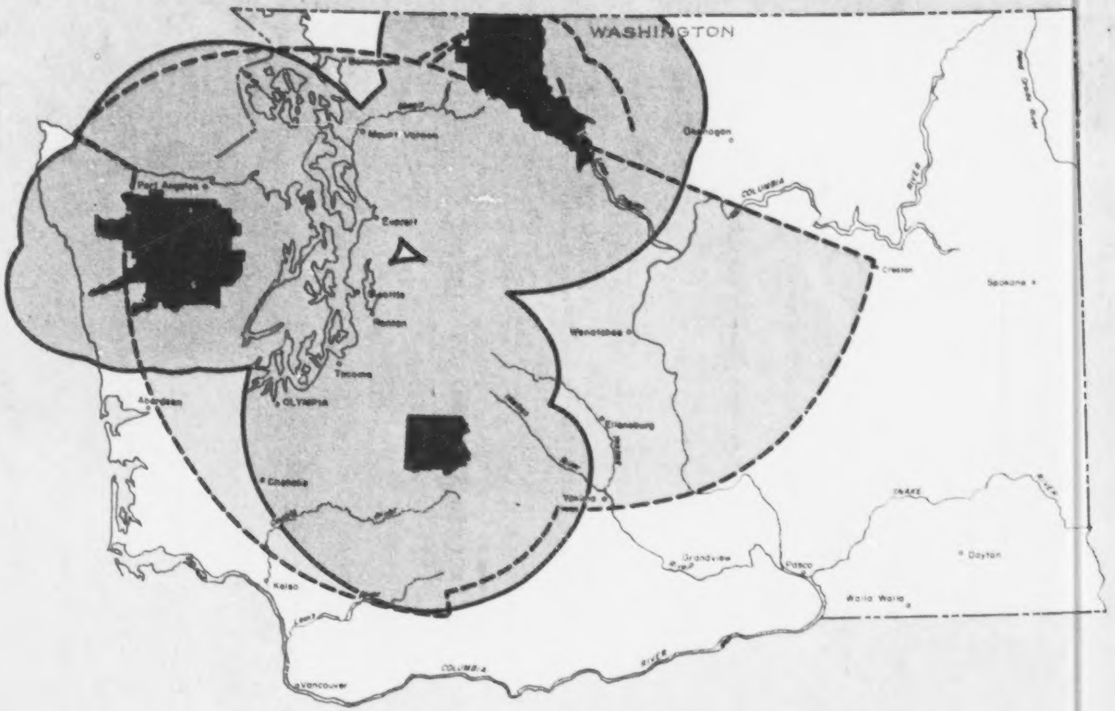
WASHINGTON
Pend Oreille River
Okanogan
Port Angeles
Mount Vernon
Everett
Seattle
Renton
Tacoma
OLYMPIA
Aberdeen
COLUMBIA
Creston
Spokane
Wenatchee
Ellensburg
Yakima
Chehalis
Kelso
Vancouver
Grandview
Pasco
Walla Walla
Dayton
SNAKE
RIVER
COLUMBIA
RIVER

EXHIBIT 1
Integral Vista Impact on Washington State

UTILITY MEMBERS OF WEST ASSOCIATES

Arizona Electric Power Cooperative, Inc.

Arizon Power Authority

Arizon Public Service Company

City of Anaheim Utilities Department

City of Burbank Public Service Department

City of Colorado Springs Department of Public Utilities

City of Glendale Public Service Department

City of Los Angeles Department of Water and Power

City of Pasadena Water and Power Department

Colorado-Ute Electric Association, Inc.

El Paso Electric Company

Nevado Power Company

Pacific Power & Light Company

Platte River Power Authority

Public Service Company of Colorado

Public Service Company of New Mexico

Salt River Project

San Diego Gas & Electric Company

Sierra Pacific Power Company

Southern California Edison Company

Tucson Electric Power Company

WILLIAM A. KUCHARSKI

Mr. Kucharski is the senior Environmental Engineer for Pacific Power & Light Company (Pacific), based in Portland, Oregon. In this capacity, Mr. Kucharski is responsible for managing the air quality related matters of Pacific's coal-fired generating facilities. This includes acting as the primary liaison between Pacific and relevant air quality regulatory agencies, and supervising air quality related licensing.

Mr. Kucharski received a BS from the U.S. Coast Guard Academy in 1966, and Master of Science degrees in Chemical Engineering and Water Resources Engineering from the University of Michigan at Ann Arbor. He is a registered professional engineer in Oregon and Wisconsin and has been employed by Pacific since 1979. Prior to joining Pacific, Mr. Kucharski was employed by Gilbert/Commonwealth Associates and Wisconsin Electric Power Company as a licensing engineer and by Allis chalmers Company as an engineer in the coal gasification division.

Mr. Kucharski is married and resides in Portland.

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p/o:

III am
6/27/81

TESTIMONY ON THE CLEAN AIR ACT

Senate Committee on Environment and
Public Works

June 27, 1981

My name is Ruth Weiner, and I am a resident of 1328 23rd St., Bellingham Washington. I am Professor of Environmental Studies at Western Washington University, where I have been a faculty member for seven years. I have been teaching courses in air pollution and dispersion modeling for ~~the last~~ over ten years. I am here today representing the Sierra Club and the Washington Environmental Council.

My testimony includes comments on all of the Clean Air Act [CAA]. The first part of the testimony, however, will focus on the questions of Prevention of Significant Deterioration [PSD] and visibility protection.

PSD policies were mandated by a 1973 court decision that the people of the U.S. had a right to the preservation of air that was cleaner than what is permitted by the Federal ambient air quality standards, even the secondary standards. Section 101[b] of the CAA reads:

"The purposes of this title are...to protect and enhance the quality of the Nation's air resources..."

"Protection" is the key to a PSD policy; it implies maintenance of the condition of an airshed, even if that condition is cleaner than the rest of the law permits.

It was recognised early on that, since "deterioration" could result from as small a change as one additional automobile, all deterioration could not be prevented, and the concept of "significant deterioration" was launched. This concept is defined in the current act, and, as with any legislative definition, is somewhat arbitrary and represents a political compromise [the word "significant" in legislation generally heralds political compromise]. The compromise now in the act is a compromise between the cost of pollution control to both the polluters and the general public and the public welfare and enjoyment of clean air resources. It is not a compromise with health - that is, in theory, protected by the ambient standards. The PSD policy assists materially in health protection, since the healthfulness of air is directly proportional to its cleanliness.

Many of us would like to see a more stringent PSD policy, in several respects. First, we would like to see an extension to all criteria pollutants, instead of the current limitation to SO_2 and particulate matter. Not only are some Class I areas threatened by pollutants resulting from automobile exhaust, ozone in particular, but there are an increasing number of stationary hydrocarbon sources which may threaten such areas. The proposed Northern Tier pipeline terminal, near Olympic National Park, would be mainly a hydrocarbon emitter. The recent EPA ruling on the Northern Tier proposal addresses the SO_2 question, since that is part of current PSD policy, but not the hydrocarbon question. Then, a more stringent policy could also be promulgated if the PSD regulations were based on incremental emissions into an air basin rather than on increments in the ambient levels. I suggested such an approach in testimony to EPA in 1974; emissions are both easier to measure - one is dealing with larger numbers - and considerably easier to estimate for a proposed source.

Current provisions of Sections 160 through 169 of the Clean Air Act should be retained and, in some cases, strengthened. Both the Class I and

Class II designations are vital to airshed protection [Class III is something of a moot point: would we want to make any area clean enough to allow a Class III increment that dirty from one or a few new sources?] I would like to discuss Class II first, since there is more controversy surrounding Class II.

Section 163[b] of the CAA allows the following increments under ClassII:

Particulate matter, annual mean	19ug/m^3
Particulate matter, 24-hr max	37 ug/m^3
SO$_2$, annual mean	20 ug/m^3
SO$_2$ 24-hr max	91 ug/m^3
SO$_2$, 3-hr max	512 ug/m^3

This numbers amount to approximately one-third of the corresponding Federal ambient secondary standard, except for the 24-hour particulate matter increment, which is closer to one-fourth of the Federal secondary standard. Since most of the U.S. is class II, and since the sort of development by heavily polluting industries envisioned in most of the country involves a dispersal of such industries rather than a future heavy concentration in any area, these increments provide a good balance between industrial growth and airshed maintenance. We recognize that there are no "non-polluting" industries, and that any heavy industry growth will result in increased air pollution, even when the standard of "lowest achievable emission rate" is applied.

It has been argued that the monitoring and dispersion modelling necessary to determine compliance with Class II is too cumbersome and expensive, and that the modelling, in particular, is inaccurate and can bedistorted to suit the purpose of the group doing the modelling. I would like to argue strongly for retention of Class II. In the first place, I live in a community which represents and ideal application for Class II. Bellingham is a community of about 50,000 people. There are several heavy industries, notable a sulfite pulp mill in the middle of town, but there is good dispersion and currently the air is quite clean. A recent survey done by some of our students indicates that the public recognizes and appreciates the cleanliness of the air in the community. Bellingham does anticipate an influx of industry and, indeed, is probably one of the better locations for some industries. Without the protection of the Class II increments, Bellingham, and communities like it, would be swamped by heavy industries in the next decade. It is difficult for new industries to move into non-attainment areas and airsheds that are currently near the secondary standards, and such airsheds should probably not have the burden of many more polluters because of attendant health problems . Without Class II, communities like Bellingham could become the Gary, indianas of the West. Class II assures a dispersal of new industry.

Section 165[b] and Section 165[e][2] require one year of monitoring and a model of the impact on the airshed of any proposed source which will emit fifty tons of pollutant or more per year. Fifty tons is quite a bit; this amont can result in ambient ground-level concentrations of pollutant as high as 150 ug/m^3 ; if the pollutant is NO$_2$ this would exceed the 24-hour ambient primary standard. If the pollutant were SO$_2$, it would exceed the 24-hour maximum allowed increment. My point is not that these excesses must happen, but that the minimum size of these facilities must not be increased - it's a bit high now. The one-year monitoring requirement has been assailed; however, for monitoring to mean anything, it must go on over a one-year period, and it should be continuous. Ambient concentrations of pollutants depend most heavily on wind direction and atmospheric stability. Movement of pollutants in the air are described by the following equation:

$$\chi(x,y,z) = \frac{Q}{2\pi u \sigma_y \sigma_z} \exp[-y^2/2\sigma_y^2][\exp[\frac{-[z-H]^2}{2\sigma_z^2}] + \exp[\frac{-[z+H]^2}{2\sigma_z^2}]]$$

and the maximum ground level ambient concentration is given by

$$\chi_{max} = \frac{2Q}{\pi u e H^2} [C_z/C_y]$$

where Q is the rate at which the pollutant is emitted from the stack, u is the wind speed, H is the effective stack height [which also depends on wind speed and direction and on other meteorology, and σ_y, σ_z, C_z and C_y are constants depending on the general stability of the air. The purpose of including this equation in the testimony is simply to show that wind speed, wind direction, and the ambient stability of the air [the general meteorology] determine what the ambient concentration of a pollutant will be. The wind shifts throughout the day, and there are large shifts in wind direction during the year. It is a truism to recognize that wind speed varies widely. The effect of all this is that monitoring for one or two days, or even several days spread throughout the year, can give a completely false picture of pollutant concentrations. Monitoring for several days each week throughout the year would give more accurate data, but if that sort of monitoring system were set up, one might as well monitor continuously. Without adequate monitoring, there is no way to assess the impact of a new source on an airshed. Even if there are no major stationary sources in the area, monitoring is needed to measure the pollutants brought in by long-range transport. Moreover, the adverse effects of air pollutants on health indicates that we should have comprehensive monitoring networks in place anyway.

Dispersion modelling has been criticized as being arbitrary and producing results which can be easily bent to serve a predetermined result. It is certainly true that models can be manipulated, but it is equally true that manipulation is easy to detect and discredit. Without modelling, there is no way to assess the environmental impact of a source which has notyet been built.

The equation given above is the basis for air pollution dispersion models. It was first developed by D.W Briggs for the U.S. Atomic Energy Commission to look at dispersion of radioactive material from nuclear power generating plants. A "dispersion model" is simply the application of this first equation to a given source but using different values for wind speeds and meteorological constants. When the results are then mapped for different wind directions, a pattern or "model" of ambient pollution concentrations can be drawn. A model is calibrated - adjusted for real conditions - by applying it to an existing source for which the ambient pollutant concentrations are being measured, and adjusting the model so that it yields measured values. A model is as good as the data that goes into it, and as good as its calibration. In recent years, since more and better monitoring is done, several models have been developed which are quite refined. Models are not difficult to apply: I teach an undergraduate course, as is done at many universities, and the APCA teaches several short courses in the use of models.

Air dispersion models are part of most environmental impact assessments. NEPA and most state environmental policy acts require it, as do many zoning change actions. In short, this is a recognized, readily implemented technique for assessing the impact of a proposed facility on the air environment. It is not burdensome, and ought to have been done prior to construction of air contamination sources for the last fifteen years, not just since 1977. It is, in fact, a cheap way to determine how much polluting a source is doing, and also, where the bestspecific location for a pollution source should be to minimize its adverseimpact [I have used models on several occasions before the B.C. Pollution Control Board to help locate an industry properly in an airshed].We do too little airshed planning, and it is the easiest way to minimize adverse pollution effects. For this reason, if for no other, the current requirements for Class II should remain. Finally, to my knowledge, there has been no case where the existence of the Class II increments has hampered industry siting or prevented industrial construction. Class II is, in fact, representative of what polluting industries should have done by themselves, but never did, since they never admitted to any adverse environmental impact prior to passage of the Clean Air Act.

It has been suggested that the 24-hour and three-hour maximum increments be eliminated, and only the annual geometric mean remain in the law. This would make a mockery of PSD: the annual mean is just that - an average of high and low concentrations of pollutant. A low annual average can be attained with no more constraint on emission than frequent and large shifts in wind direction. Let me give an example: the annual mean increment allowed for SO$_2$ for Class I is 2 ug/m^3. This could be achieved with an actual ambient concentration of 30 ug/m^3 - higher than the three-hour maximum - provided that the wind direction in which that 30 ug/m^3 occurred shifted equally around the points of the compass during the year. An individual experiencing polluted air experiences the short-term maxima rather than the annual averages. Moreover, all enforcement is done on the basis of short-term . Finally, the annual averages, when they are computed, are firgured by a series of approximations that is much less well established than other air pollution calculations - it is really something of a "black art"

My comments on modeling, monitoring, and the retention of short-term standards apply to Class I designations as well as Class II. The Class I increments given in Section 163[b] of the CAA are:

Particulate matter, annual mean	5 ug/m^3
Particulate matter, 24-hour max	10 ug/m^3
SO$_2$, annual mean	2 ug/m^3
SO$_2$, 24-hour max	5 ug/m^3
SO$_2$, 3 hr max	25 ug/m^3

Class I is intended to protect those areas of the U.S. whose natural state is protected by other legislation as well: national parks, wilderness areas, etc. This protection serves a vital purpose other than esthetics and recreation, however: the preservation of clean air "reservoirs" which will ultimately be needed to dilute the existing pollution. We have failed to provide such reservoirs in some parts of the U.S., particularly in the Northeast, with the result that an entire section of the country is now polluted.

There are only two methods for cleaning the air: rain [washing the pollutants out] and dispersion - dilution with clean air. When the clean air is gone, there is nothing with which to dilute. The preservation of clean air reservoirs was one of the moving arguments for PSD in the first place. It is an argument essentially similar to that used for preservation of land nd water - that we may well need these resources in the future. There is also a powerful commitment on the part of Americans to preserve theit natural heritage for its own sake. Polls earlier this year showed that 70 percent of those polled favored natural area preservation. A very recent Harris poll showed also that 86 percent of those polled favored retention or strengthenin of pollution control regulations. The concept of Class I areas has been supported by the general public.

When Class I was first promulgated, there were industry fears that the existense of these areas would markedly curtail industrial expansion; the NAM even published a statement that no industry could be built closer than 50 miles to a Class I area. Of course, these fears were unfounded and have not been justified. The "50-mile" number was arbitrary and is incorrect; again, the distance between the polluter and the air basin depends primarily on wind strength and direction. The ASARCO smelter in Tacoma - the largest SO_2 emitter in Washington - is within 50 miles of Mt. Rainier N.P. [the smelter predates Class I by about seventy years], but the major impact of the SO_2 emissiions is on the local community [less than 50 miles from the smelter] and on rain acidity in Lake Washington and the Alpine Lakes [more than 50 miles from the smelter]. Obviously, neither the smelter location nor Mt. Rainier N.P. will be moved; this only serves to illustrate that there is no arbitrary distance between source and airshed that applies to all Class I areas. This also shows that dispersion modeling is indispensable to PSD.

Most of the U.S. is not Class I. The additional Class I designations allowed under Section 164, even if made wherever possible, would result in only a small fraction of the U.S. being Class I. The major argument for Class I, however, is not that there aren't many such areas, but that it is in the American tradition of land and natural heritage preservation, and is consistent with a century of American policy toward its unique public lands. The United States has the oldest national park system in the world; our history of public land preservation predates that of most nations by half a century or more. Class I designation is part of the public land preservation system.

Another reason for maintaining and extending the Class I system is that, fortuitously, many fragile public land areas have equally fragile airsheds. In Alaska, for example, the extremely low temperatues, slow lapse rates, and very dry air create very different dispersion conditions than exist in the "lower 48". Dispersion of pollutants in the arctic is far poorer than in the north temperate zone, and the "ice fog" problem complicates the concentration of pollutants in some areas. The considerable amounts of heat emitted through an industrial stack [which disperse the pollutants in the first place] have a much more marked effect in an arctic climate than in a temperate one. There are grave questions about what kind and size of polluting industries should be located in the arctic at all: PSD is the first step in addressing that question.

Fundamentally, since Americans cherish, and have a right to, their national parks,monuments, and wilderness areas, they have an equal right to airsheds over those areas which meet the same standards of protection. Moreover, if the citizens of a state wish to preserve state lands in thesame manner, they have a right to demand protection of those airsheds as well. State protection of airsheds is generally not enough: air pollution does not respect state boundaries, or any other political boundary. In sum, Sections 160 through 165 should remain intact; they offer invaluable airshed protection, and are a first step in proper airshed planning. They are also one of the few sections of the CAA which addresses the questions of cumulative effects and very long range transport of pollutants, which is shall discuss later in my testimony.

Section 169A, protection of visibility, is also an important section of the CAA. The report on measurement and modeling methods required in 169A[3] was actually a preliminary document - we are learning more about visibility measurement all the time. My colleague, Dr. Michael Ruby, will comment in some detail on methods of measurement and standard setting, so I will restrict my comments to some general observations and to some policy questions.

First, as Dr. Ruby can demonstrate readily, visibility and the impairment of visibility are readily measureable and definable; good, reproducible visibility standards can be set, either in terms of distance or of contrast between distant objects and background. Reduction of visibility is directly proportional to the concentration of particles in the air - a measurement which, interestingly enough was first made in Seattle in 1969 [Noll, K.E. et al Atmospheric Environment 2, 1969]. Visibility protection is obviously important for the enjoyment of Class I areas, and should include views both into and out of the Class I area in question, but it also has ramifications for health protection. The colloidal-size, aerosol particles which hamper visibility also are those which remain in the air the longest, and which are small enough to be inhaled into the alveoli of the lungs.

I believe that we will also find that the Class I standards for particulate matter and SO_2 provide visibility protection as well, in most cases. Since visibility varies locally, varying degrees of protection may be required. Visibility is, of course, affected by other pollutants than SO_2 and particulate matter; ozone and NO_2 probably have the major adverse effects. Section 166 of the CAA mandates a study of other pollutants than SO_2 and particulate matter for possible PSD regulation. We need PSD standards for these pollutants very badly, not just to protect visibility, but for general Class I and Class II protection. There has been considerable reluctance to set PSD standards for the automotive-related pollutants [CO, hydrocarbons, lead, ozone] because of the implied limits on automobile traffic in mandatory Class I areas. Hopefully, the rising prices of fuel, and of automobiles themselves, will counteract this reluctance. We have long needed better mass transportation systems in the national parks and monuments [Grand Canyon is really the only one with an adequate system]; answering this need will act in conjunction with better protection under Class I.

Inclusion of the remaining criteria pollutants under Class II is essential to better airshed planning. We should definitely not wait until all the urbanized areas of the U.S. become non- attainment areas before expanding Class II - it would obviously be too late then. ClassII is not so much restrictive as it is a planning tool - we should not be afraid to use it as such. Moreover, we can then take into account the effects of stationary hydrocarbon emitters [ports, tank farms, refineries]. The intent of Congress was to include all criteria pollutants under PSD eventually; we need to meet that intent.

I would like to close this section of my testimony by expanding on a suggestion I made in 1974 at the EPA hearings on PSD: that PSD standards be set for emissions into an air basin as well as for the ambient air in the basin. This would result in better control, better and cheaper enforcement, and better and easier monitoring. The major reasons are:

1. Emissions from a source can be readily and easily calculated from emission factors. These, in turn, require less, and less costly, data gathering than the data needed for ambient modeling. Ambient modeling must still be done, but there would be a cheap backup system.

2. Emissions are easier and cheaper to measure than ambient levels of pollution, and can be measured with considerably greater precision and accuracy. The reason for this is simple: emissions involve amounts of pollutant 10,000 to several million times as large as ambient concentrations. The larger the number you are measuring, the easier it is to make precise measurements. Ambient monitoring also invoves a large number of variables, and is heavily dependent on monitor placement. In emission monitoring, you know exactly where to put your monitor.

Since the effects of air pollutants depend on ambient concentrations - what everyone breathes - emission standards would be correlated with the existing ambient increments [in Section 163]. This is not difficult to do. If this system of emission and ambient increments were adopted, implementation of PSD would be greatly simplified.

For the record of the hearing, I would like to present testimony on the other sections of the Clean Air Act, and to include in this testimony comments on HR 3471 [the "Broyhill amendments"]. I have included a copy of a letter to my Congressman, the Honorable Al Swift, detailing my objections to HR 3471, as Appendix A of my testimony.

Standards and the Clean Air Advisory Committee

Both the Administration's draft bill and HR 3471 suggest an expanded role for the Clean Air Scientific Advisory Committee in giving final approval to ambient and emission standards and supervising the sandard-setting process. This sort of suggestion sounds good: an independent scientific committee to oversee EPA. It is, however, another bad move intended to undermine EPA and gut the power of the CAA, for the following reasons:

1. At least one version of the amendments expands the Scientific Advisory Committee to include three members of the industries being regulated and a designee of the Council on Economic Advisors. Why these individuals should assist in setting standards which protect health escapes me, and I can think of no better "fox-guarding-the-henhouse" situation. Nor is it evident that any of these representatives belong on a "scientific" committee nor that they would have knowledge of, or interest in, health protection.

2. Even if the committee is not expanded, one can hardly be assured that its deliberations will be objective. All of us have had experience with expert consultants; one can always find equally qualified and knowledgeable consultants who will give exactly opposite opinions. These men and women should not have oversight over standard setting precisely because they are not in government employ and do not thus represent the people of the U.S., but their own private particular interests.

Final say on standards and standard-setting procedures must rest with EPA. Advisory committees are valuable and useful, but must remain advisory.

It has been proposed [and was actually first proposed by Athur Stern in 1971] that only primary standards be retained and secondary standards be done away with. This may make sense for a pollutant like CO, whose major effect is on human health, but it doesn't make sense for most pollutants. SO_2 and particulates affect vegetation adversely at lower concentrations than those which have health effects: these secondary standards need to be retained. Because of phytotoxic effects and atmospheric transport and acidification, secondary standards should be set for NO_2 and ozone as soon as possible. We must also retain the ability to set secondary standards for other pollutants, if knowledge of such effects should increase. We do not need anything in the CAA that allows states to set more stringent ambient standards than EPA; states already have this power and exercise it.

It is vital that the current basis for health standards remain in the CAA: protection of health [with no modifiers like "against significant risk"], protection of everyone's health, protection without "cost/benefit" considerations. Healthy air is something Americans have a right to; there are no offsetting economic benefits!

State Implementation Plans

The current CAA requires EPA approval of State implementation plans [SIPs]. It also requires that states show that the 1982 [or, in some cases, 1987] deadlines will be met, and sanctions are available if the SIP is not adequate, particularly in the case of non-attainment areas. Specific emission standards are required for criteria pollutants, and , in non-attainment areas, sources are required to meet "lowest achievable emission rate". Current SIP requirements are by no means the last word, but they need to be strengthened, not weakened, as both the Administration and Broyhill propose to do. The only real action we have had in non-attainment areas has been subsequent to passage of the 1977 amendments. The only real action I have ever observed in any of the five states where I have served as a consultant on air pollution [Colorado, Florida, Arizona, Nebraska, Washington] has been with EPA backup. The states had the power to do something about air pollution for all those decades prior to passage of the 1970 CAA: they did exactly nothing, and they would do nothing again, given half a chance. A state which has weak or lax or non-existent air pollution regulations has an economic advantage over a state with stringent regulations.

The proposal that a SIP be approved unless EPA disapproves within 90 days might work and speed things up if, and only if, EPA were adequately staffed and funded. But to institute this program at a time when funds are being decreased is simply a hidden way of weakening the Clean Air Act.

Finally, the phrase "reasonably available control technology" should be recognized for the weak, least common denominator of control that it is. In general, "reasonable" means "the least the polluters can get away with".

Hazardous pollutants

There is no question that the current mechanism for listing an air pollutant as "hazardous" [under Section 112 of the CAA] is too long and cumbersome: we have tried to get arsenic listed for the last seven years. The procedure needs to be speeded up; however, it is vital that health risks be assessed conservatively, and that the margin of safety remain.

Tall stacks

A tall stack improves dispersion of a pollutant; it does not control or decrease emission of that pollutant. Thus, a tall stack is not, and should not be considered, a pollution control technique. In particular, tall stacks, because they aid dispersion, enhance long range transport of pollutants, and thus make they acid rain problem worse. Proposals that tall stacks substitute for emission controls should be rejected out of hand,

Mobile sources

It has been proposed that the CO emission standard be weakened from 3.4 gm/mile to 7.0 gm/mile, since this could be achieved with a two-stage rather than a three-stage catalytic converter, resulting in lowered cost and simplified maintenance. It is certainly arguable that the 3.4gm/mile standard could be changed, but why not change it to the best which can be achieved with a two-stage catalyst: 5 gm/mile or thereabouts. Going from 3.4 gm/mile to 7.0 gm/mile is simplistic.

Proposals have also been made to do away with the requirement for inspection and maintenance [I/M] and to remove EPA authority to do transportation planning. Neither of these proposals would enhance the cleanliness of the air: both are designed to draw attention away from America's Number One Air Polluter: the automobile. I/M works and, where it is in place, is popular. A voluntary exhaust emission study done by the Washington Department of Ecology showed, on an average, a 45 percent failure rate in exhaust emission controls. Just building the controls in is not enough; they will not be maintained unless maintenance is forced, because maintenance is expensive and doesn't improve operation of the car.

Transportation planning must be included under EPA authority because to achieve clean air, we must also have less use of cars; we can't do it with emission controls alone.

Summary

None of the proposals made by the Reagan Administration [in draft] or in the Broyhill amendments would strengthen the Clean Air Act. They are special interest proposals, designed to get the polluting industries off the hook. None of these proposals were suggested by health organizations, health professionals, citizens' organizations, or environmental groups. None of the proposals benefit the worker, the ordinary middle-class citizen, or those in ill health. These are nothing but self-serving suggestions by the big polluters.

We need to maintain standards of clean air which protect health with a margin of safety, and which get the U.S. into the habit of airshed planning and airshed preservation. The Clean Air Act is far from perfect, but it needs to be stronger, not weaker. We do not have any regulations in the Clean Air Act that we don't need: the regulations are there because the polluting industries consistently refused to clean up on their own initiative. I have spent the bulk of my testimony refuting weakening proposals: we badly need draft legislation on strengthening proposals, streamlining regulations, andadd ressing long-range cumulative problems like acid rain. But if all we can do is hold on to the Clean Air Act as it is, that's far better than anything the Administration or Broyhill propose.

A Harris poll released last week showed that 78 percent of those polled thought air standards were abour right or not protective enough, and 86 percent thought that the Clean Air Act was just about right or should be stricter [38 percent wanted the CAA stricter than it is now!] The percentages varied very little form the eastern U.S. to the western U.S., cities to suburbs, young to old respondents. Nobody except the polluting industries thinks that the Clean Air Act represents over-regulation; most people are glad of the regulation, and a lot think that there is not enough. Let's do what the people want, and authorize a stronger, not a weaker, Clean Air Act.

APPENDIX A

Ruth F. Weiner
1328 23rd Street
Bellingham, WA 98225
(206) 733-3985

June 14, 1981

The Hon Al Swift
US House of Representatives
Washington, DC 20510

Dear Al,

Here is the letter I promised you on the Broyhill Amendments [HR 3471]. What I will do in this letter is a point-by-point analysis of HR 3471, and my objections at each point. The numbers I use refer to Sections of the Clean Air Act, except where I refer specifically to HR 3471.

Amendments to Section 10

HR 3471, p.1, 1.5-11: This is a wholesale shift of funds from Federal enforcement to State enforcement of the CAA. we had state enforcement until 1970, and the states failed totally in their attempts at air pollution control. The only adequate control we have ever had in the US has been federally mandated and supported. The state of Washington is particularly contrary in its attitude toward clean air: Pete Hildebrandt of the state DOE has said publicly that he didn't think the 1970 Act was needed and the air in Washington was just fine then.

Amendments to Section 108

Section 108, Air Quality Criteria and Control Techniques, is the "guts" of the Clean Air Act: the section which guarantees that the health of the nation's citizens will be protected. It is also the major focus of Broyhill's attack!

HR3471, p.2 1. 13-20 This shifts the authority to set standards from the EPA administrator to the "Scientific Advisory Committee". Not only is this a cumbersome procedure, but, more important, the Broyhill Bill proposes to include in this committee [HR3471, p.8, 1. 14-22] "industries subject to the provisions of this Act" and "the Chairman of the Council of Economic Advisors". If that's not the fox guarding the henhouse, I don't know what is! Industry in the US has fought for weak or nonexistent ambient air standards since the first comprehensive Federal act in 1967. This proposal alone makes a mockery of the standard-setting procedure.

HR 3471 p.2,1.23 - p.4, 1.5, in particular, p. 3 1.10-14: "... identify all demonstrated and confirmed effects on public health..." and p. 3 1. 25, et seq: "If the Administrator... determines that any critical clinical or toxicological study...is of questionable validity, the Administrator shall...carry out another study before taking final action..." This section sounds good, but is fatal to the Clean Air Act for the following reason: public health and epidemiologic data are, by their very nature, not specific and difficult to confirm beyond the shadow of a doubt. The assessment of public health hazards is based on statistical evidence, e.g., more oat-cell lung cancers occur in smelter workers than in the general population, rather than a specific cause and effect relationship. One can never say that a given substance was the cause of a particular cancer or a particular respiratory disease in a particular individual - you can't even say that for cigarettes and lung cancer. Every textbook on toxicology and epidemiology makes this point.

So how does one assess public health hazards? What we do, and what is done in the present Clean Air Act? One does exactly what the present Clean Air Act says: identify emissions which"may reasonably be anticipated to endanger public health" and act on information on "the types of pollutants which...may interact...to produce an adverse effect on public health and welfare..."[Sec. 108[a] of the CAA.] In other words, the Administrator is directed to make judgments on standards which are conservative with respect to protecting human health.

In making such judgments, it is recognized [indeed, pointed out in textual material on public health] that indivudual susceptibility to pollutants varies very widely. Currently, our standards are set to protect most - more than three-fourths - of the population. Such protection requires such judgments.

HR3471 p.3, 1.25 - p.4, 1.5 is objectionable because there is always question and some conflicting opinion about toxicological and epidemiological studies which could be interpreted as "of questionable validity" by those disagreeing with it or seeking to discredit it. Essentially, this language would mean that we would have no standards at all - the studies would take forever.

HR 3471 p. 4, 1.18-23 [Subsection [C]] This section requires a cost/benefit study for air pollution control techniques. This is already done and is adequately assured in Sec. 108[b] [1].

HR3471 p.4. 1.24 - repeal of Sec. 108 [e] and [f]. This repeals the authority of EPA to assist in transportation planning, programs to control automobile emissions, and programs to reduce automobile use. It guts the power of EPA to control the nation's Number One Polluter - the automobile; was this section written by General Motors?

Amendments to Sec. 109

Sec. 109 is also basic to the Clean Air Act - as basic as Sec. 108.

HR 3471, p. 6, 1.1-11. This section directs the Administrator to promulgate standards for pollutants which pose a "significant risk", rather than directing promulgation of standrds which are "requisite to protect the public health and welfare", as the current Clean Air Act states .

Similar language is contained in HR3471 p. 8 1.3-7, which proposes to "protect then,public welfare from significant risks" rather than protection of "the public welfare from any known or anticipated advers effects..." Sec 109 [b] [2]. How would a "significant" risk to public welfare be determined, especially if representatives of the regulated industries were partly responsible for the determination? More important, a "significant" risk to health is also difficult to define. Does it include risks to young children, elderly people, those already suffering from respiratory disease? Asthmatics? What is a significant risk to an asthmatic, as compared to an insignificant risk to an asthmatic?

This language has only one intent: to weaken the standards and allow more pollutants to be emitted into the air. If passed into law, it will result in a lot worse air for a lot of people who have some trouble breathing now.

HR3471, 1. 12- p. 9, 1.3 This concerns inclusion of industry and the Council of Economic Advisors on the Scientific Advisory Committee, and granting to that committee of review powers over EPA in standard setting; I commented on this on the first page of my letter.

Amendments to Sec. 110

Section 110 concerns implementation and State enforcement of the CAA.

HR3471, p. 9, 1.17-25. This eliminated the nine-month time limit for filing State Implementation Plans [SIPs], and essentially sets no time limit within which an SIP must be filed. It also gives automatic approval to a SIP unless the EPA Administrator acts within 90 days. Is EPA going to be funded and staffed adequately to meet this deadline? I doubt it. Again, if air pollution control is left up to the states, nothing happens - we have years of evidence to back that up. This would be an acceptable provision if EPA had the staff to do rapid reviews.

HR 3471 p. 10, 1. 13-18. This changes the deadline for compliance from 1982 to 1990; a totally unnecessary change, since all but a very few areas of the US will meet the 1982 deadline.

HR3471 p.10, 1.19-20: this appears to remove transportation controls from the SIP.

p. 10, 1. 21-22; this is a repeal of inspection and maintenance [I/M] plans for automobile exhaust. The auto industry, of course, has screamed about I/M for years. In fact, I/M programs have proved both effective and popular, and pay for themselves at a relatively low cost to the driver [the programs in Seattle will cost $10.00/year] A study donoby the Washington DOE in Seattle in 1977 indicated that automobile exhaust emission controls had a 45 percent failure rate , showing that I/M does something. It is, in fact, a major auto smog control program.

HR 3471, p. 11, 1.1-21; this substitutes a three-year "rolling review" for the 1987 deadline for states which have non-attainment areas due to auto exhaust and cannot meet the 1982 deadlines. Currently, all but eight communities in the US are expected to meet the 1982 or 1987 deadlines. There is no need nor reason to eliminate these deadlines: they are the basis on which citizens can judge how well clean air programs are doing.

HR 3471, p. 11. 1.22-25: this essentially repeals the provision that new stationary sources can only be built in non-attainment areas if the additional emissions into the air are offset by emission controls on other sources. Essentially, this section makes a mockery of the non-attainment program for stationary sources. Under the current CAA, the emissions offset program for new sources in non-attainment areas appears to have begun rather well. The provision of the CAA which this section repeals [Sec. 110 [a][2][I] has not prevented new industry construction.

HR 3471 p. 12. 1.1 is part of the previous repealer.

HR 3471 p. 12, 1. 2-14; this provides that State revisions of SIPs become automatic 90 days after submission unless EPA acts within the 90 days to rule otherwise. The same objection applies to this as to the automatic EPA aaptoval of SIPs cited on the foregoing page [the first amendment to Sec. 110] . Under this provision, states can simply flood EPA with SIP revisions, which experience shows will rarely, if ever, be in the interests of clean air.

HR 3471, p. 12, 1.22-23, gives the state one year after notification by EPA to file an adequate SIP, instead of 60 days. This extension is in addition to the Administrator's discretionary extension, which is already in the CAA [Sec 110[b]], and after the State's failure to meet the SIP filing requirements.

HR 3471 p. 13, 1.10-19: this repeals almost all EPA authority to require transportation plaaning, control of aggregates of cars, and auto use in congested areas in the State SIP. It would mean that control of automobile use is effectively eliminated from SIPs except for some non-attainment areas.

HR 3471, p. 13, 1. 20 - p. 14, 1. 11 This allows a state, on its own authority to determine that an energy emergency exists andto suspend SIP controls on a fuel-burning stationary source. In the present CAA [Sec. 110 [f]] this is allowed only on Presidential determination of an emergency. Once again, giving such autority to the states effectively removes control.

HR 3471 p. 15, 1. 9-18 This allows removal of transportation control programs and I/M programs from SIPs at the will of the state, and will undoubtedly result in the removal of most of those programs from SIPs throughout the nation. The only control we have ever had on auto emissions has been what was federally mandated and forced by the threat of federal sanctions. This sort of amendment just drops controls on car-induced pollution.

Amendments to Section 111

Much of HR 3471, pp. 15-17 codifies what is, unfortunately current practice in setting new source performance standards. This process is dominated by the polluting industries [although under President Carter the program was probably the best it had ever been]. We should really go back to operating as Sec. 111 of the CAA intends. [I say this with some personal knowledge; I served on the Air Pollution Control Techniques Advisory Committee for three years during the Nixon-Ford administration].

HR 3471, p. 17, 1. 13-16: "greater continuous emission reduction"[emphasis mine] means greater reduction of emissions, or less pollutant emitted, than "a greater degree of emission limitation", which is the proposed substitute language

Amendments to Section 112

Section 112 deals with control of particularly hazardous substances. The Broyhill Bill proposes that the designation ofaa pollutant as a hazardous substance be made by the Scientific Advisory Committee, which includes members of the regulated industries, etc. The same objections hold for this amendment as for having this committee make the final judgments on criteria and standrads: this will be a committee motivated by economic and industry considerations, rather than by protection of health. Even the judgment of the scientific members of such a committee is often open to question: these are too frequently consultants in the pay of industries being regulated. The public interest is served much better if these decisions are made by EPA.

Amendments to Section 113

HR 3471, p. 18, l. 18-20. This amendment makes enforcement discretionary . We can all imagine what an Administrator like the current one would do in the case of violations of the CAA.

Amendments to Section 120

This section deals with non-compliance penalties. Again, the Broyhill Bill, p. 19-20, makes assessing such penalties discretionary. The proposed amendments to this and the preceding section simply remove the teeth from the Clean Air Act [so it would have neither teeth nor guts!]

Amendments to Section 123

This section of the CAA refers to the use of very tall stacks. In general, tall stacks result in better dispersion of air pollutants than short stacks; moreover, the ambient concentration of pollutants is markedly decreased by the use of tall stacks. However, a tall stack does not in any way decrease the amount of a pollutant emitted into the air. For this reason, the current CAA limits the use of tall stacks and recognizes that they are not an emission control technique. The Broyhill Bill allows tall stacks to be used as an emission control technique.

This would have particularly grave consequences for the acid rain problem: acid rain is a cumulative problem, and long-range transport plays a role in depositing sulfuric acid far from where it was generated. The taller the stack, the better the possibility of very long range transport.

Additions to Part A

The proposed additional sections 129 and 130 would have relatively little effect. The proposed ten-year grandfather for new plants which meet existing standards is something that is done in practice anyway. The section on state permit programs gives the states discretionary authority to require permits for construction and/or operation. The states have this authority now, and some of them exercise it. These sections are not really needed.

Amendments to Sections 160-169: Prevention of Significant Deterioration

HR 3471, p. 26, 1.23-24 proposes to strike the words "actual or potential" so that Sec. 160 would read "to protect the public health from adverse effects..." instead of "from actual or potential adverse effects..." However, the whole purpose of this section is prevention of deterioration. In order to prevent deterioration, potential effects of sources which do not as yet exist must be considered. The proposed change would change the whole meaning and thrust of these sections.

HR 3471, p. 27, 1. 3-4: again, striking "existing cleanair resources" [emphasis mine] would change the whole meaning of these sections, which is to preserve existing clean air resources.

HR 3471 p. 27, 1.12-14; this would strike 24-hour and 3-hour maximum allowable increases, leaving only the annual average maximum allowable increase. This would be essentially contrary to the meaning of PSD, since almost any actual deterioration can be hidden in an annual average. Using only the annual average allows a great many excursions which would degrade the airshed considerably. Almost no industry emits at a steady continuous rate, and it is all too easy to circumvent PSD if only an annual average is used. The short-term maxima are the ones that are used in both modeling and monitoring to determine actual or potential violations. Without them, PSD is meaningless.

HR 3471 p. 27, 1.15-16: this eliminates Class II and Class III designations. Elimination of Class III is probably a good idea [the only one in the Broyhill Bill]; many of us never wanted a Class III anyway. Eliminating Class II is a different story. Bellingham is probably a good example of where ClassII can serve its intended function. Bellingham has very clean air, but anticipates industrial expansion. There is no reason why an place like this should attain the dirtiness of the secondary standard, which is pretty dirty; this would certainly harm other values the community has. PSD was meant to protect clean areas which would experience growth and development, as well as very clean areas like national parks. I am sure there are other communities - many of them throughout the U.S. - which would benefit from the Class II limits. There is no area where the existence of Class II has interfered with planned development or industrial expansion. It should be retained.

HR3471 p. 27, 1.17-p. 28 1.9. This section of the Broyhill Bill is one of the most insidious weakening amendments to the CAA. It says, essentially, that the federal primary ambient standard - the standard designed to protect health - may be exceeded if the pollution source violating the standards "provides other environmental and public health benefits", if the violations don't occur too often, if it's expensive to control, and if the population at risk is small. This is appalling! Doesn't a small population have the same right to health protection as a large one? More important, isn't this like saying that we will make an exception to the laws prohibiting bank robbery if only small banks are robbed, if the robbers don't do it often, and if the money stolen is used to provide other public benefits? Robbing a bank to build a municipal swimming pool would be acceptable under this interpretation of law.

The preceding proposed amendment reveals the sponsor's true intention: to circumvent the Clean Air Act and air pollution control wherever possible, so the big industrial polluters don't have to clean up. They've been stalling for years, and now they've got a champion in Rep. Broyhill! Moreover, this sort of amendment is grossly unfair to those industries which have complied with the CAA and have spent the money to clean up. This sort of amendment rewards lawbreaking and punishes compliance.

HR 3471 p. 281. 10-16, while it does not prohibit state reclassification of recreational, park, and wilderness lands as Class I, certainly discourages such a move by eliminating the language in the present Act [Sec 164 [a]] which specifies that sort of designation. Nothing is gained by the proposed amendment; much is lost.

HR 3471, p. 28, l. 19 - p. 39 l. 5. This amendment makes the monitoring and modeling required for new sources under the CAA [Sec 165] at the discretion of the State rather than mandatory. I have already commented [ad nauseam?] that state regulation and enforcement is almost meaningless unless backed up by federal sanctions; there are two additional points to be made here. First, in the absence of Class II, where only mandatory Class I areas are protected, airshed planning involving monitoring and modelling are crucial. For mandatory Class I areas, federal land is involved in any case, so the decision should not be left up to the state, nor are there that many areas as to be burdensome. Second, airshed planning is what we don't do and haven't done, and the absence of that planning is what has got us into this situation in the first place. The last thing we need to do is discourage airshed planning

HR 3471, p. 30 l. 6 - 17: this section proposes to substitute an emission offset policy for actual control of sources which impinge on Class I areas, which , of course, makes a mockery of Class I!

Amendments to Sections 171-178, Plan Requirements for Non-attainment Areas

In general, the Broyhill Bill here follows its consistent line of transferring authority from EPA to the state, weakening reporting requirements, and allowing alternate action to actually improving the control of emissions. Two amendments are especially worth noting:

HR 3471 p. 34 l.8 This repeals the federal sanctions, and of course makes compliance with this section, especially with those parts dealing with automotive pollutants, virtually impossible to attain.

HR 3471 p. 34, l. 9-12 substitutes "reasonably available control technology" for "lowest achievable emission rate". "Reasonably available control technology" has, in our experience, come to mean whatever the polluter thinks he can afford and can talk the state into.

Amendments to Sections 300-327

These amendments essentially make the CAA consistent with the other proposed amendments, and remove the power of federal sanctions from EPA.

A Summing Up

I am sure you will give this close attention, as you are a key member of the House committee which will be hearing the bill. There is nothing in the Broyhill Bill that will cause the air to be cleaner, or that will result in faster attainment of clean air. Moreover, there is nothing in the bill of benefit to the average citizen, and a great deal which could be detrimental to those with respiratory problems, the old, and the very young, and pregnant women - quite a large population!

Nothing in the Broyhill Bill was proposed by health professionals, by any health-associated organization, by any citizens'organization, by any organization of Democrats, or by any environmental group. . The Broyhill Bill is a big-industry bill; it would not benefit anyone else!

Thank you for giving this you attention. I hope to be able to discuss this further with you during the August recess.

Sincerely .

Ruth Weiner

cc: David Gardiner, Sierra Club
    Janet Chalupnik, Washington Lung Association
    Roger Leed, Washington Environmental Council

PUGET SOUND AIR POLLUTION CONTROL AGENCY
TESTIMONY ON CLEAN AIR ACT REAUTHORIZATION
BEFORE SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
SEATTLE, WASHINGTON JUNE 27, 1981

Good afternoon. My name is Arthur R. Dammkoehler and I am representing the Puget Sound Air Pollution Control Agency. Our agency is responsible for control of stationary air pollution sources in the central Puget Sound region, comprising King, Kitsap, Pierce and Snohomish Counties and serving a population of some 2.1 million persons. We also operate an air monitoring program and are the lead agency for long-range air quality planning in the region. Our Board of Directors, composed of elected officials from the four-county area, has endorsed the Clean Air Act recommendations offered below.

The Puget Sound Air Pollution Control Agency has worked with provisions of the Clean Air Act since the Act's first major amendments were adopted in 1970. In our opinion, the Act works. Having the force of federal law behind local attempts to carry out pollution control regulations and the force of federal deadlines to impart some urgency and reality into air quality planning has been invaluable.

Before the Clean Air Act was passed, individual states had broad authority to control air pollutants. Proposals are now being made that this authority be returned to the states. One of the main reasons for the 1970 Clean Air Act amendments was that this state "control" proved largely ineffective. States adopted standards based on inadequate research. Deadlines for attainment were not set. There were no consequences if attainment was not achieved. Different states held different environmental values. Some were frankly sympathetic with polluters because of the economic contribution of large sources, and set their "controls" so laxly as to encourage shopping by industry for "pollution havens". The 1970 Clean Air Act and the 1977 Amendments were passed to give consistency and uniformity to air pollution control in this country at a level that actually protects public health. State and local officials need the support of uniform national standards and deadlines to help resist pressures to relax controls in order to attract and retain industry.

One of the primary reasons often advanced for relaxing environmental controls is that an undue burden is placed on business and the economy due to the expense of compliance. It is our contention that compliance with the Clean Air Act actually benefits the economy of the Puget Sound region. Recently an official of the Seattle/King County Convention and Visitors' Bureau predicted that if Boeing's business (now our largest employer) remains essentially stable, the visitors' industry here could become the No. 1 employer within a few years. Presently, tourism and convention hosting is an $800 million per year business creating 60,000 jobs in King County. By 1990, it's estimated these totals will rise to around $2.5 billion and 100,000 jobs.

The beauty of the physical surroundings of the Pacific Northwest is one reason often cited by visitors as to why they choose this area to vacation in. The Puget Sound region's environmental attractions are touted in convention and meeting literature as an inducement to prospective attendees. Air that is dirty and that does not meet health standards is a negative advertisement for any region. A strong Clean Air Act will help ensure that this important aspect of our regional economy continues to prosper.

Our specific positions on the Act were developed in response to recommendations of the National Commission on Air Quality, which submitted to Congress in March the results of 2½ years of study of the Act. With some significant exceptions, we generally support the recommendations of the Commission. Many of their proposals would maintain significant provisions of the current Act, streamline certain requirements and add important new elements to the law. In particular, we support the following recommendations:

- ECONOMICS SHOULD NOT BE CONSIDERED IN SETTING THE PRIMARY AIR QUALITY STANDARDS. National Ambient Air Quality Standards should be maintained as clear goals of those levels of air quality needed to protect public health. Costs should not enter into setting such standards. Economics can be considered through the setting of specific emission limitations and developing implementation programs.

- THE DUPLICATIONS AND DELAYS OF STATE IMPLEMENTATION PLAN (SIP) APPROVALS SHOULD BE REDUCED. Approval of SIPs has taken upwards of two years in some cases, due to unnecessary and prolonged federal reviews and duplication of state and local publication and public hearing procedures. Alternative administrative procedures could maintain adequate review and public participation without delaying approval.

- AN INHALABLE PARTICULATE STANDARD SHOULD BE DECIDED WITHIN ONE YEAR. The question of an air quality standard based on particulate matter in the size range capable of reaching deep into the lungs has gone unanswered for too long. Delay in issuance of the size-specific standard has caused a postponement of strategies to meet the total suspended particulate matter standard. Further delay can only lead to continued impacts to public health. Delay also creates uncertainties and planning problems for affected industries who will be expected to meet the standards.

- HAZARDOUS AIR POLLUTANTS SHOULD BE CONTROLLED TO A GREATER EXTENT. EPA has had authority to bring hazardous pollutants under control but only four such pollutants have had standards set. Action is needed to speed up the listing of hazardous pollutants and development of standards and controls to reduce their impacts.

- CONTROL OF ACID RAIN SHOULD BE INCREASED. Precipitation with a pH factor below 5.6 occurs throughout the nation and the effects of acid rain on fresh water lakes have recently been demonstrated. The existing provisions of the Clean Air Act do not adequately address this potentially serious problem.

- A CONTROL PLAN FOR INDOOR AIR POLLUTION SHOULD BE DEVELOPED. The jurisdiction for controlling indoor air pollution in public buildings has not been well-defined. The Clean Air Act is the natural statute for defining this responsibility and addressing this public health issue.

In contrast to the above, certain of the Commission's recommendations would repeal or modify vital requirements of the Act, jeopardizing progress to clean air. Contrary to the Commission's suggestions, our agency believes

- MANDATORY ATTAINMENT DATES SHOULD NOT BE REPLACED WITH THREE-YEAR REVIEWS. Attainment deadlines have forced complete, effective and timely submittals. Without such deadlines, additional controls would be difficult to mandate. For certain areas and for certain pollutants an extension beyond the existing deadlines may be needed. However, this should be done through case-by-case evaluation, fixing new extended attainment dates.

- I/M REQUIREMENTS SHOULD BE RETAINED WHEREVER VEHICLE-RELATED AIR POLLUTION IS A PROBLEM, NOT JUST IN LARGE CITIES WITH SIGNIFICANT PROBLEMS. Inspection and Maintenance (I/M) of vehicle emissions has been found to be the most cost-effective measure, other than new car standards, to meet mobile source-related ambient air quality standards. It is true that public perception of I/M programs prior to implementation is often skeptical. This has made adoption of programs difficult. Once implemented, though, existing I/M programs have demonstrated public support. I/M programs have been approved in several areas; this extremely effective control measure should not be stalled by eliminating the federal mandate.

- NEW CAR EMISSION STANDARDS FOR CARBON MONOXIDE SHOULD NOT BE RELAXED FROM 3.4 TO 7.0 GRAMS PER MILE. The Commission has argued that a 7.0 gram per mile technology automobile actually gives higher emission reductions than the 3.4 gram automobile, due to the failure rate in 3.4 gpm technology cars. The auto industry should prove that better technology could not be installed to prevent such high failure rates. Further, areas with vehicle inspection and maintenance programs will identify failing vehicles and require maintenance. Reducing new car controls may put the burden on local governments to implement more stringent transportation controls.

- REQUIREMENTS FOR APPLICATION OF LOWEST ACHIEVABLE EMISSION RATE (LAER) IN NONATTAINMENT AREAS SHOULD NOT BE REPEALED. Reaching attainment involves reducing emissions. Areas already burdened with poor air quality must be protected from new source emissions. LAER forces the use of the best controls possible. Repealing LAER could force existing sources to install further controls to accommodate new industrial emissions because the less stringently that new sources are required to control, the more existing sources will have to make up the difference to reach attainment. Otherwise, economic growth could be limited. LAER requirements need not delay permitting of new facilities if the program is correctly administered and a LAER clearinghouse maintained.

- FEES IN LIEU OF OFFSETS SHOULD NOT BE ALLOWED IN NONATTAINMENT AREAS. The emission offset program is vital to allowing growth within areas having poor air quality. Offsets allow industrial expansion while maintaining progress toward the clean air standards. Our agency has found that sufficient emission offsets are available to accommodate growth. Fees collected in lieu of offsets would not be set at a high enough cost to encourage the creation of the offsetting emission reductions.

o NATIONWIDE REDESIGNATION OF NONATTAINMENT STATUS (AS OF DEC. 31, 1981) IS UNNECESSARY AND UNWISE. Nonattainment designations should be based on the best available information. The Act already allows redesignations in individual areas where new information becomes available. A nationwide redesignation effort would lead to confusion, repetition and duplication of efforts and should be avoided.

- EPA SHOULD NOT BE GIVEN MORE "FLEXIBILITY" FOR TAKING CIVIL ACTIONS AGAINST NON-COMPLIANT SOURCES. More, not less, federal enforcement may be needed when state or local authorities are unable to bring sources into compliance. The Act's provisions for federal Notices of Violation and noncompliance penalties have been the most direct and successful mechanisms to force industry to control sources in violation of air pollution regulations. EPA should pursue all non-compliant companies without discrimination, enforcing rules firmly and consistently.

  As noted earlier, we support giving greater discretion in day-to-day implementation of air quality programs to state and local governments to avoid delays and duplications. We believe procedural safeguards can be built into this process that will adequately protect the public interest and yet permit a reduced federal presence. But we call for a continuing strong federal role in approving overall state plans and ensuring that state and local programs lead to improvement of air quality within the deadlines set in those plans. We also call for a continuing federal role in, and increased funding for, enforcement.

- EPA SHOULD NOT BE GIVEN GREATER DISCRETION TO IMPOSE A MORE GRADUATED RATE OF SANCTIONS ON AREAS NOT MAKING A REASONABLE EFFORT TO SUBMIT OR IMPLEMENT A CLEAN AIR STATE IMPLEMENTATION PLAN (SIP). In Washington State's case the passage in 1979 by the State Legislature of an

Inspection and Maintenance law for vehicle emissions was directly influenced by the legislature's consideration of the effect of federal funding sanctions on the state's economy. The sanctions in the present Clean Air Act are a powerful weapon and not to be used lightly. However, the historical infrequency of EPA's use of sanctions shows that this power is reluctantly if at all brought to bear and that fears that sanctions will be too readily imposed are unfounded.

- CLASS II AND III AREAS UNDER THE PREVENTION OF SIGNIFICANT DETERIORATION (PSD) PROGRAM SHOULD NOT BE ELIMINATED. The PSD program has a critical goal of keeping areas with good air quality from increases in air pollution over a fixed "budget" ceiling. We acknowledge that the administration of PSD regulations has been complicated and confusing. One reason for this has been the court challenges and subsequent revisions. The regulations must be simplified. However, an air pollution budget approach is necessary to insure long-term protection of our clean air resources. Without such a budget, there would be no incentives for improved technology or creative mechanisms to enable growth to continue within limited air resources. Elimination of these programs could also shift employment away from traditional employment centers, impacting the economics of current industrial areas.

As noted earlier, our region's economic health is partially dependent on visitors drawn by our attractive environment. Under the 1977 Clean Air Act amendments, regulations which went into effect in January 1981 were adopted to provide special protection for the visibility values of Class I national parks and wilderness areas. From both an economic and an aesthetic perspective, we support keeping these regulations in effect. But we also have many areas in the Puget Sound region and elsewhere in Wahsington State that possess clean air and yet are not designated national parks or wildernesses. For example, nearly eight million acres in the State of Washington are National Forest Lands. For these areas the major protection is to retain the Prevention of Significant Deterioration (PSD) program without serious weakening.

- THE CLEAN AIR ACT SHOULD BE REAUTHORIZED WITHOUT MAJOR MODIFICATION.

In summary, our experience with implementing the Clean Air Act has been largely positive. As indicated above, there are areas where we believe some procedural streamlining may be necessary. But on the whole we have found the Act's provisions reasonable and workable. After many years of effort, the Puget Sound region is on schedule for attaining the clean air standards by 1987. Our progress is directly attributable to the standards deadlines, and non-compliance sanctions contained in the Clean Air Act. We urge the Act's reauthorization without major modification.

PUGET SOUND AIR POLLUTION CONTROL AGENCY

POSITIONS ON THE CLEAN AIR ACT

Based on Recommendations

of the National Commission on Air Quality

INTRODUCTION

On March 3, 1981, the National Commission on Air Quality released their report "To Breathe Clean Air" containing 109 recommendations on changes to the Clean Air Act and its implementation. These recommendations may serve as a guide as Congress considers amendments to the Act. It has been evaluated by the Puget Sound Air Pollution Control Agency and serves as the basis of our specific comments on the Clean Air Act.

RECOMMENDATIONS SUPPORTED BY PSAPCA

Generally, we support the recommendations of the Commission. Many of their recommendations would maintain significant provisions of the current Act, streamline certain requirements and add important new elements to the law. In particular, we support the following recommendations:

NCAQ Recommendation No. 1: Economics should not be considered in setting the primary air quality standards.

National Ambient Air Quality Standards should be maintained as clear goals of those levels of air quality needed to protect public health. Costs should not enter into setting such standards. Economics can be considered through the setting of specific emission limitations and developing implementation programs.

NCAQ Recommendation No. 10: An inhalable particulate standard should be decided within one year.

The question of an air quality standard based on particulate matter in the size range capable of reaching deep into the lungs has gone unanswered for too long. Delay in issuance of the size specific standard has caused a postponement of strategies to meet the total suspended particulate matter standard. Further delay can only lead to continued impacts to public health.

NCAQ Recommendation Nos. 15-18: Hazardous air pollutants should be controlled to a greater extent.

EPA has had authority to bring hazardous air pollutants under control but only four such pollutants have had standards set. Action is needed to speed up the listing of hazardous pollutants and development of standards and controls to reduce their impacts.

NCAQ Recommendation Nos. 25-27: A control plan for indoor air pollution should be developed.

The jurisdiction for controlling indoor air pollution in public buildings has not been well defined. The Clean Air Act is the natural statute for defining this responsibility and addressing this public health issue.

NCAQ Recommendation Nos. 29-30: The duplications and delays of SIP approvals should be reduced.

Approval of SIP's has taken upwards of two years in some cases, due to unnecessary and prolonged reviews and duplication of publication and public hearing procedures. Alternative administrative procedures could maintain adequate review and public participation without delaying approval.

NCAQ Recommendation Nos. 95-97: Increase control of acid rain.

Precipitation with a pH below 5.6 occurs throughout the nation and the effects of acid rain on fresh water lakes have recently been demonstrated. The existing provisions of the Clean Air Act cannot adequately address this potentially serious problem.

RECOMMENDATIONS NOT SUPPORTED BY PSAPCA

In contrast to the above recommendations, certain of the Commission's recommendations would repeal or modify vital requirements of the act, jeopardizing progress to clean air. Those recommendations with which PSAPCA most strongly disagrees are as follows:

NCAQ Recommendation No. 52: Replace mandatory attainment dates with three-year reviews.

Attainment deadlines have forced complete, effective and timely SIP submittals. Without such deadlines, additional controls would be difficult to mandate. For certain areas and for certain pollutants an extension beyond the existing deadlines may be needed. However, this should be done on a case-by-case evaluation, fixing new extended attainment dates.

NCAQ Recommendation No. 57: Repeal requirement for lowest achieveable emission rate (LAER) in nonattainment areas.

Areas having poor air quality must be protected from new source emissions. LAER forces the use of the best controls possible. Repealing LAER could force existing sources to install further controls to accommodate new industrial emissions. Otherwise, economic growth could be limited. LAER requirements need not delay permitting of new facilities if the program is correctly administered and a LAER clearinghouse maintained.

NCAQ Recommendation No. 59: Allow fees in lieu of offsets in nonattainment areas.

The emission offset program is vital to allowing growth within areas having poor air quality. Offsets allow industrial expansion while maintaining progress toward the clean air standards. Our Agency has found that sufficient emission offsets are available to accommodate growth. Fees collected in lieu of offsets would not be set at a high enough cost to encourage the creation of the offsetting emission reductions.

NCAQ Recommendation No. 61: All areas should be re-examined for nonattainment status as of December 31, 1981.

Nonattainment designations should be based on the best available information. The Act now allows redesignations where new information becomes available. A nationwide redesignation effort would lead to confusion, repetition, and duplication of efforts and should be avoided.

NCAQ Recommendation No. 72: Class II and III areas under the Prevention of Significant Deterioration program should be eliminated.

The PSD program has a critical goal of keeping areas with good air quality from increases in air pollution over a fixed budget ceiling. The administration of PSD regulations has been complicated and confusing. One reason for this has been the court challenges and subsequent revisions. The regulations must be simplified. However, an air pollution budget approach is necessary to insure long-term protection of our clean air resources. Without such a budget, there would be no incentives for improved technology or creative mechanisms to enable growth to continue within limited air resources. Elimination of these programs could also shift employment away from traditional employment centers, impacting the economics of current industrial areas.

NCAQ Recommendation No. 77: Relax new car standards from 3.4 to 7.4 grams per mile for carbon monoxide.

The Commission has argued that a 7.0 technology automobile gives higher emission reductions due to the failure rate in 3.4 technology cars. The auto industry should prove that better technology could not be installed to prevent such high failure rates. Further, areas with vehicle inspection and maintenance programs will identify these failing vehicles and require maintenance. Reducing new car controls may put the burden on local governments to implement more stringent transportation controls.

NCAQ Recommendation No. 49: Eliminate I/M requirements except in large cities with significant problems.

I/M has been found to be the most cost-effective measure, beyond new car standards, to meet mobile source related ambient air quality standards. However, public perception of I/M programs prior to implementation is often skeptical. This has made adoption of programs difficult. Once implemented, though, existing I/M programs have demonstrated public support. I/M programs have been approved in several areas and this extremely effective control measure should not be stalled by eliminating the federal mandate.

NCAQ Recommendation No. 86: Give EPA more flexibility for taking civil actions against noncompliance sources.

More, not less, federal enforcement may be needed when state or local authorities are unable to bring sources into compliance. The Act's provisions for federal Notices of Violation and noncompliance penalties have been the most direct and successful mechanisms to force industry to control sources in violation of air pollution regulations. EPA should pursue all noncompliant companies without discretion, enforcing rules firmly and consistently.

Public Comment to the EPA regarding CARBON MONOXIDE: Proposed Revisions to the NATIONAL AMBIENT AIR QUALITY STANDARDS. November 6, 1980

To: Central Docket Section (A-130)
Environmental Protection Agency
Attn. Docket No. OAQPS 79-7
401 M Street, SW
Washington, D.C., 20460

From: MARILYN M. STANTON
E. 1540 So. Riverton
Spokane, Washington 99207

Chairman of the Spokane City-County Air Pollution Authority
(Resolution of 9 September, 1980 grants me authority to speak for this body. Filed on October 10, 1980, at the hearing in Denver, Colorado).
Associate Professor of Biology, GONZAGA UNIVERSITY, Spokane, Wash. 99258.
Former Councilwoman, City of Spokane (1976-1980). Expenses for this report and my appearance in Denver on October 10, 1980 are being met by the City of Spokane.
Member of the Board of Directors of the AMERICAN LUNG ASSOCIATION, State of Washington.

Gentlemen:

Unless otherwise specified, all references cited in this PUBLIC COMMENT refer to the FEDERAL REGISTER, Vol. 45, 161 for Monday, August 18, 1980: "Proposed Rules".

It is the position of the Board of Directors of the Spokane City-Council Air Pollution Authority that:

See Section #1 following

A. With the discrediting of the Beard-Wertheim data, it is now obvious that the 1971 carbon monoxide (CO) standards for both the 8-hour and the 1-hour periods were much too strict. The 8-hour standard would have been set at 27-30 ppm instead of the present 9ppm; the 1-hour standard would have been set at 50 or more ppm instead of the present 35ppm...if only replicated experiments had been the basis of judgment.

It is now clear that it was a grave error to set the national standards on the basis of un-replicated experiments. In fact, the 1971 standards were so far out of line with the confirmed experimental data as to constitute a national scandal.

See Sections #2,3, 4,5,6 & #7

B. The EPA seems not to learn from its past mistakes. The EPA is presently using un-replicated experiments as the basis for its proposed 1980 standards. (See Table 2 on p. 55073, and discussion on p. 55081 of the FEDERAL REGISTER). Each of the experiments by Anderson and by Aronow have data which is open to question, as well as data that is unreplicated. Moreover, the important Coburn prediction chart for COHb% (Table 1 on page 55072) has been changed significantly in the FEDERAL REGISTER from its first appearance in the EPA publication of June 1, 1979 ("Preliminary Assessment of Adverse Health Effects from CO." (Staff paper).

C. The EPA duly noted on p. 55066 (FEDERAL REGISTER) that the Beard and Wertheim data was no longer being used by them. But the EPA failed to inform the public that the 1971 standards were set much too strict because of the EPA's use of this now discredited experiment. It would seem that the EPA is seeking to hide the consequences of using un- replicated experiments by not listing in the "References" of the FEDERAL REGISTER its own "Air Quality Criteria for Carbon Monoxide: March, 1970" published by HEW under National Air Pollution Control Administration Publication No. AP-62. Only this

1970 document can demonstrate to the public the undue confidence the EPA placed on the Beard and Wertheirm experiments.

The EPA seems to be biasing the public by failing to cite publications of scientific groups whos opinions run counter to those of the EPA. For example, the "Reference" section fails to list the latest (1977) book on carbon monoxide by the National Academy of Sciences, "Carbon Monoxide: Medical and Biologic Effects of Environmental Pollutants"..a report supported by Contract No. 68-02-1226 of the EPA!

See Section #8

While on the other hand, the EPA in the FEDERAL REGISTER quotes from the now outdated (1971) report from the National Academy of Sciences which supported the new, stricter proposed 1-hr standard. The 1977 report cited in the paragraph above does not support a stricter 1-hour standard. It seems to us the the EPA had been dishonest in its use of work done under the name of the National Academy of Science.

D. Publications regarding CO by the EPA's various "citizen" committees seem to regard an endogenous reading of more than 0.5% as "abnormal". This attitude runs counter to reports of normal women at various stages in their reproductive cycle where readings as high as 1.5% COHb are seen. Once again an article citing this data is not lised in the FEDERAL REGISTER although articles (other than this one) are cited for Dr. Coburn.

See Sections #9 & #10

Nor has the EPA pointed out that OSHA permits 50ppm of CO for eight hour periods. And there have been no reports from OSHA about adverse health effects for either normal people, or for those with respiratory/cardiovascular disease. Yet the EPA is suggesting that ambient air of 9ppm, if breathed for 8-hours, is seriously damaging to health of people with cardiovascular diseases. Note OSHA allows COHb of 7.6%; EPA standards are 1.5%!

In Summary: The EPA's own data, Table 11-0 on p. 11-85 of AIR QUALITY CRITERIA FOR CARBON MONOXIDE, October, 1979 (Preprint EPA 600/8-79-022) shows that between the so-called "normal" endogenous readings of 0.5% COHb and 5.0% COHb there are no replicated studies proving harm to normal or to diseased humans.

This translates into and 8-hr. standard of 30ppm, and into a 1-hr. standard of over 50ppm. With reasonable standards such as these few cities in the United States would have trouble complying with the EPA edicts.

However, since CO-monitors are often set above street levels and theredore may miss recording the higher sidewalk-level values of CO..and since at congested interactions there may be occasional high bursts of CO (the"bolus effect")..it is the opinion of the Spokane Air Pollution Authority that an 8-hour standard of 15-20ppm would be more prudent than the 30ppm standard proposed in the paragraph above.

While we in Spokane sincerely believe that an 8-hr. standard of 15ppm (COHb of 2.5%) would protect the health of almost all citizens, we must consider the most extreme cases. Therefore we propose a standard of 12ppm for 8-hrs. This would protect even a woman who is a very heavy smoker, pregnant, with chronic lung disease, angina pectoris, intermittent claudication, pernicious anemia, who is leaving her home at sea-level Seattle to visit her mother who lives in high-altitude Denver, Colorado.

Spokane will therefore support what we consider a "generous" standard of 12ppm for 8 hrs., and a 1-hr standard of 35ppm for cities like Spokane, and a 1-hr standard of 25ppm for cities like Denver who have high-altitude effects. This would involve COHb of 2% for normal non-smokers. However, we will vigorously protest any standard more strict, as being utterly unscientific and unduly protective of the health of our citizens. To this end we will use political pressure and public awareness via release of this report to the media.

Sections(#1 - #9), supporting "Positions" given on pages 1 and 2.

1. Problems involved in the setting of the 1971 CO Standards:

On P. 55066 THE EPA staff admits that the Beard & Wertheim data for a 1967 experiment should not have been used to set the CO standard of 9-ppm for eight hours (1971 standard). This Beard data indicated that breathing concentrated CO long enough to produce COHb of approximately 2.5-3.0% caused impairment of time-interval discrimination in non-smoking humans. (This would be roughly equivalent to breathing 10-14 ppm CO for eight hours.) On the basis of this single experiment, one which had not been replicadted, the EPA decided in 1971 that breathing 10=ppm CO for eight hours was detrimental to human health. The EPA evidently thought a safety margin of 1-ppm was sufficient, and thus the U.S. standard was set at 9-ppm CO for eight hours.

In the interval between 1971 and 1978 many groups tried to obtain the same detrimental Central Nervous System effects with CO-Hb levels at 2.5-3.%. None could replicate the Beard experiment. It is now obvious that the EPA should never have considered data that had not been confirmed by other scientific groups. The embarassing position that the EPA now finds itself in comes from a philosophy that merely because an experiment has "not been refuted", and because that experiment was published in a reputable primary scientific journal read by "peers" that the data is worthy of carrying the heavy burden of setting air pollution standards for a whole nation.

Note that if the Beard & Wertheim experiment had been set aside in 1971, the EPA would have fallen back on the other experiments it had approved, and the 8-hr standard would have been set at 25-30ppm .. not the present 9-ppm! Spokane would not have any "CO problem" today if the EPA had followed scientific principles back in 1971...neither would most cities other than the notorious few like Los Angeles and Denver.

This point is clearly shown in Tables 8-16 and 10-1 and the "Conclusions" of pages 10-5 and 10-6 of the IAR QUALITY CRITERIA for CARBON MONOXIDE, March 1970, National Air Pollution Control, Administration Publication No. AP-62.

2. Problems with the Aronow experiments from 1971-1977 (Table 2, p. 55073):

None of these Aronow et. al. experiments, on which the EPA is basing the proposed standards, has ever been replicated. Therefore the EPA may be placing itself in the same precarious position of that of 1971 with the Beard & Wertheirm experiments.

It is not rational for the EPA to state that such experiments have had "peer review". Only after several groups have tried these same experiments and have either confirmed or not confirmed the results can peers have any basis for a "review".

And there is further reason for caution. The prestigious American Journal of Medicine this year found itself printing a letter of retraction from Drs. Soman and Felig regarding a fraudulent article printed in 1979. The shakeup at Yale University and at Columbia College of Physicians and Surgeons is reviewed in the Science (AAAS) article of October 3, 1980, "Imbroglio at Yale (I): Emergence of a Fruad" and shows that "peers" never suspected that the data in Dr. Soman's many articles was not true.

I do not mean to imply by the above remarks that the Aronow experiments are not in every way true and reliable. I merely point out that "peers" have no way at present to evaluate them. I would point out, however, that in the Aronow experiments published from 1971-1978 concerning the detrimental effects of low

CO, that every subject in his groups (which are all small, 8-12 subjects) show this detrimental effect. It is most unusual that over the years..as far as i have been able to find..not one person in the Aronow CO-tables deviated from the Aronow hypophysis. Whenever an hypophysis was confirmed, all subjects agreed.**

On the other hand in other experimental data by numerous other CO articles some patients show increased physiological capabilities, although the group as a whole may have shown decreased capabilities. For example, in the work of K.M. Brinkhous, "Effects of Low Level Carbon Monoxide Exposure, June 1977, EPA-600/1-77-032 (Contract No. 68-02-1281) Tables 4 and 5 on pages 18 and 19 show that most subjects showed a decrease in exercise time after exposure to different amounts of CO but always a few showed an increase. This Brinkhous type of raw data is the type one would expect in such experiments.

Even the Anderson experiment which I critize for low COHb readings (Reference #6 of the FEDERAL REGISTER) showed expected data for individual patients. For example, Anderson's Table II (P. 49) indicates that patients 2,6, and 9 were "healthier" after breathing CO of 100ppm for 4 hrs, while patients 1,3,4,5,7,8, and 10 were "sicker" after breathing the CO as compared to breathing compressed air. This non "lock-step" type data is what most credible experimenters get.

On the other hand the Aronow article, Reference #6b in the FEDERAL REGISTER, Table II of p. 394, shows all ten of Aronow's patients were "sicker" after breathing CO of only 50ppm for only 2 hours! Both Anderson and Aronow used agina patients.

All the articles by Dr. Aronow that I have been able to obtain show this** same "lock-step" type of data for his individual patients..whenever such data is given. Often Aronow just reports "mean values". But whenever individual patient's data is shown, and a carbon monoxide hypothesis is supported by the majority of patients, there is no minority report because no patient ever gets out of "lock-step."

3. Problem with the Anderson et. al. 1973 Experiments on Anginc (Table 2, and remarks on p. 55073 of the Federal Register).

The EPA staff on p. 55073 notes that the Anderson report on individual variations to time of pain showed one individual why complained at the very low COHb level of 1.3% byt had a control starting level of zero (0.0% COHb . Since there is always some endogenous COHb the staff wisely questioned the validity of "this data point."

But the EPA staff failed to note that all of Andersons experimental data is suspect since his patients were breathing 50-ppm CO for four hours but their COHb increased very little..from the average of 1.3% to a high of only 2.9%. From the Coburn table of Table 1 (p. 55072) and Table 2, p. 19 of STAFF PAPER of June 1, 1979, PRELIMINARY ASSESSMENT OF ADVERSE HEALTH EFFECTS FROM CARBON NONOXIDE AND IMPLICATIONS FOR POSSILBE MODIFICATIONS OF THE STANDARDS that starts at a level of 0.5% COHb, that after four hours of 50-ppm CO the COHb% would be at least 5.2!

According to the Coburn Table (which EPA staff says is very reliable) the Anderson figure for four hours at 100-ppm CO is also incredibly low. Anderson reports a figure of only 4.5% COHb, whereas other investigators have reported 8-10% COHb.

I believe the Anderson experimental data should not be used when considering national CO standards, since COHb levels are not in line with the Coburn Table nor reported data by other investigators.

Incidentally, why does the Coburn Table 1 (p. 55072 - FEDERAL REGISTER) of August 18, 1980, give data for only 1 hour and 8 hours, whereas the same Coburn data of the STAFF PAPER of June 1, 1979 gives data for 1 hour, 2 hours, 4 hours, and 8 hours? Why does the 1979 Table give categories of "Resting" vs. "Moderate Exercise" while the 1980 Table gives no "Resting" but rather a "Rest/Light Activity" category?

Is the change perhaps due to the fact that Dr. Coburn belatedly noticed that resting "alveolar" ventilation: is not the 10 Liters/minute, as he published in 1979, but rather somewhere between 4.2 and 5.2 Liters/minute according to recognized medical experts. (See John B. West's "Respiratory Physiology", Williams & Wilkins Company, 1979, p. 13; and see Wm. F. Ganong, "Medical Physiology", Lange Medical Publications, 1979, p. 500.) Which of Coburn's Tables should we believe?

4. Problems with the Aronow experiments from 1978 to present. (Table 2, p. 55073 for the 1978 study, and p. 55081 for Draft copy of the 1980 experiment.)

The 1978 Aronow passive smoking study suggested that a COHb level of approximately 1.8% is the point where aggravation of angina starts to appear in angina patients. Aronow himself admits on the last page of this study, "Finally, in addition to CO and nicotine, other components of tobacco smoke, including oxides of nitrogen and hydrogen cyanide, and possible psychologic factors(emphasis mine) may have contributed to the decrease in exercise performance observed in these patients.." There were no controls in this study since the patients were merely placed in a room with smokers and forced to inhale "second hand smoke" for two hours. Obviously the patients must have been apprehensive knowing that smoke would aggravate their problems.

Yet this uncontrolled, unreplicated experiment is now proposed by the EPA as the one for "setting a margin of safety" for the whole nation. It is obvious that by using it to "set a margin of safety" the EPA is in effect making CO standards more strict to fit it! This is "double-speak"!

The EPA announced (p. 55801) that they had underwritten a new, 1980, Aronow study which corrects the defects of the 1978 one, and shows that COHb levels of only 2% (breathing 50ppm CO for 1 hr.) decreases exercise tolerance significantly in angina patients. But since no one but Aronow can get such results (EPA officials told me in Denver on Oct. 10, 1980 that there were no other medical facilities that could do the type of experiment Dr. Aronow does!) until this experiment is replicated it is no more trust-worthy than the other Aronow experiments.

Incidentally, the published version of this 1980 Aronow work in "Chest" (Sept. 3, 1980) is a mere summary; there is no individual patient data table given. Since the middle of October, 1980, Spokane officials have been trying to get a complete report of this experiment..without success. Calls to the EPA in Washington D.C. brought only the response that the EPA no longer has the report and we were referred to Dr. Aronow in California. Dr. Aronow told us he could not release the complete report since it would jeopardize his chances of "getting it published." Moreover, Dr. Aronow told us he was giving a report in Boston late in October. The report that came back to Spokane from that national conference in Boston gave no tables of individual reactions to CO. In other words, although this work by Dr. Aronow has been paid for by public money, is being used to set the national CO standards, it is not available to the public for "peer review". How odd!

5. Problem of lack of data proving that subjects cannot detect the "bolus" effects of 50ppm CO or 10ppm CO from time intervals ranging from one to four hours. (Anderson experiment and Aronow et. al. experiments.)

The Anderson study and many of the Aronow studies listed on Table 2 of the Federal Register were presumably "double blind" controlled studies. But the experimentors never proved.,they merely assumed.. that subjects were unable to detect the difference between breathing pure air and breathing 50ppm or 100ppm of Co for various time periods. This criticism also applies to the 1980 Aronow study.

Several health professionals working in Washington industries have remarked to me that they are very aware within a few minutes when CO levels reach 35-50ppm, and that employees that have lung and circulation problems can detect these levels also. The symptons are vague but undeniable. Nothing so obvious as a headache, but rather a certain apprehensiveness and unease. I myself observed this pheomenon when Spokane had its worst CO days in October 1974, during the last days of "EXPO 74"when the 1-hr level of 27ppm was reached.

The subtle detection by subjects of the difference between breathing air vs. breathing CO may explain why Aronow's subjects never seem to deviate from his expectations. It may be that the subjects are unconsciously aware of the presence of CO and psychologically react by performing worse. NEGATIVE PLACEBO EFFECT; see 6 below.

6. Problem of PLACEBO and NEGATIVE PLACEBO effects in Angina Patients, and those with Intermittent Claudication.

Benson and McCallie in their article "Angina pectoris and the placebo effect" in the New England Journal of Medicine 300: 1424-1429, 1979 point out that as high as 90% improvement of symptoms..both subjective and objective..can be expected in the early stages of a new therapy when enthusiasm runs high. It would not be unexpected then, that a NEGATIVE placebo effect could be seen in patients convinced that small amounts of CO could have detrimental effects. These patients must be aware of the experimentors expectations..for example, those of Dr. Aronow..and unconsciously wish to prove his hypothesis.

Since patients with intermittent claudication often are subject to arterial spasms as well as patients with angina pectoris the above remarks may well apply to patients with peripheral vasoconstriction problems. See 7 below.

7. Problem with new medical considerations as to cause and severity of angina pectoris.

In the article "Coronary Artery Spasms and Heart Disease" in Science Vo. 208, P. 1127-1130 for June 6, 1980, Jean Marx notes that spasms of the coronary arteries may be more important as a cause of angina and heart attacks than had been previously recognized. There is now a considerable challenge to the view that put all the blame for angina and heart attacks on atherosclerotic plaques that build up in the coronary arteries and cut down blood flow to the heart muscle. Although the blockage might not cause problems for the person at rest, so the old theory goes, when the heart works harder for any reason, the coronary blood flow may not be adequate to meet the increased demand for oxygen and the individual may suffer the pain of angina. In case of total blockage of the coronary arteries, a heart attack..actual death of a portion of the heart muscle or a "myocardial infarct" ..might occur.

However, it has become increasingly evident that many angina patients experienced most of their chest pains while they were at rest..frequently at the same time of day, as in the early morning hours while they were still in bed. Prinzmetal called this "varient angina". In the Science article Marx points out that a physician can be fooled by coronary angiography into thinking a vessel is almost entirely blocked by atheroslerotic plaque when in actuality the vessel is merely undergoing a spasm and little or no plaque is present.

The above remarks are not to suggest that small amounts of COHb may not have detrimental affects on patients with all types of angina. I merely point out that there is now intensive new investigations under way that are altering the old conceptions of angina. For example, the beta-blocker PROPRANOLOL (Inderol) now often used to treat angina, abnormal heart rhythms, and high blood pressure may actually exacerbate the symptoms of spasm-induced angina. It may be that discountinuing the use of propranolol and prescribing the new "calcium-antagonist" drugs such as veropamil, diltiazem, and nifedipine along with alpha-adrenergic blockers may solve many angina problems.

In the article "Constricting arteries expand view of ischemic heart disease" in JAMA Vol. 243 No. 4, p. 309-316 of January 25, 1980, Elizabeth Gonzalez notes that emontional stress is strongly suspected of playing a role. Alfred A. Kattus, MD, of Inglewood, California during the recent meeting of the American Heart Association in Anaheim, California, says that many patients are themselves convinced that stress helps to precipitate their symptons. And Dr. Maseri, professor of Cardiovascular Medicine at Hammersmith Hospital, Longon, England, says "the patient has pain when he suffers inside becouse he is unable to cope." Eugene Braunwald, MD, chairman of the Department of Medicine of Peter Bent Brighan Hospital of Boston notes that a simple stress, such as withdrawal of a banana has been shown to cause coronary artery spasm during continous blood flow measurements in baboons, and that EKG changes indicative of ischemia occur in patients subjected to psychological stress. He says, "I think the evidence is very, very strong that cerebral cortical factors influence coronary blood flow."

And Dr. Braunwald pointed out at the AHA meeting that "the most proximate cause of sudden death is electrical instability of the heart. Yet on postmortem studies, many hearts show no evidence of coronary occlusion. It is very inviting to speculate that spasm may play a role inproducing ischemia leading to these deaths.

It may be years before scientists know what causes spasm and why it is so erratic in its duration and frequency. Paul Klingfield, MD, assistant professor of medicine at Cornell University Medical College and director of the Cardiac Graphics Laboratory at the New York Hospital, New York puts int, "How many people with angina also have spasm? Maybe everybody."

In summary then, there is evidence of a strong emotional content inartery spasm. People with cardio-vascular disease are likely to react with spasm upon being told that certain conditions are harmful to them and then being put in such conditions. For instance, if patients are convinced that second-hand cigarette smoke, freeway air, or CO in small amounts is harmful to them..and they can then detect smoke, freeway air, of small levels of CO..then they are very likely to have arterial spasm and show decreased exercise ability.

8. Problem with lack of use of opinions of prominent scientists when such opinions are contrary to those held by the EPA.

Nowhere in the Federal Register is there reference made to the 1977 report by the National Academy of Sciences: MEDICAL AND BIOLOGIC EFFECTS OF ENVIRONMENTAL POLLUTANTS: CARBON MONOXIDE. I will quote from several differenct sections of this report.

A. Under category "Ambient Air Standards for Carbon Monoxide" (p. 167)

"There appears to be an adequate safety factor between the lowest COHb concentration that has been demonstrated to cause adverse effects and the maximal COHb concentration that can occur at 9=ppm carbonmonoxide for 8 hr. or 35-ppm for 1 hr."

It is obvious from that quoted above that the National Academy of Sciences in its latest report does not advocate changing the 1 hr. standard for CO from the present 35-ppm to the more stringent 25-ppm. Yet the EPA implies the National Academy of Sciences is presently calling for such a change:

> "The National Academy of Sciences has recommended a 1-hour CO standard approximately 30 percent more stringent than the present (35 ppm) standard. (p. 55076 of the Federal Register)

How many readers bothered to look up reference 59 to find that it refered to the 1971 (now out-of-date) report on CO from the National Academy? One cannot but wonder if the EPA staff is not deliberatley trying to mislead the public.

B. Under the category "Recommendations" from p. 186.

"We recommend expansion of the data base related to adverse effects of carbon monoxide on vigilance, or oxygenation of exercising skeletal muscle, and in atheroslerotic heart disease and peripheral vascular disease. Carbon monoxide standards are not set on the basis of available data in these fields. Experiments in each of these fields have been performed on a relatively small number of human subjects. There is a need for replication of studies by other laboratories."(Emphasis by Stanton).

and on p. 187

"We recommend that studies be performed to determine whether heart, brain, and exercising skeletal muscle adapt to effects of small increases in blood COHb (less than 5-10% saturation). The entire data base related to deleterious effects of CO was obtained from acute experiments. Yet exposure of the population to CO can be chronic or intermittent."

C. Under category "Relation between CO and Coronary arterial disease" from pages 123-124. Photostat below; emphasis by Stanton.

> If the results of the clinical studies are applicable to this large population at risk, then a major public health problem exists. Taking the current results at face value suggests only that, when patients with angina are exposed to low carbon monoxide concentrations for short periods, they cannot exercise as long on a bicycle or treadmill before developing chest pain as those breathing compressed air. There is no evidence from these results that the exposure to carbon monoxide increases the frequency and severity of chest pain or the development of other complications or that it shortnes life expectancy among patients with angina pectoris or other clinical manifestations of heart disease. We can only infer the existence of such a relationship.

> Evidence for this association based on observations is equivocal. People with angina pectoris who smoke cigarettes can be expected to have higher carboxyhemoglobin concentrations and poorer prognosis than those who do not smoke cigarettes. The harmful effect could be due both to carboxyhemoglobin and to other chemicals in cigarette smoke. A recent study has shown, on the other hand, that relatively few heart attacks occur while an individual is cigarette smoking and is thus exposed to higher carbon monoxide concentrations. There is no evidence of an increased heart attack risk, including myocardial infarction and sudden death while driving an automobile, and there are no data showing the occurrence of episodes of angina pectoris pain in relation to specific activities.
>
> There is also no evidence suggesting a higher incidence, prevalence, or prognosis of heart disease among industrial workers who are exposed to high carbon monoxide concentrations.
>
> And finally, there is little positive or negative evidence indicating that high ambient carbon monoxide concentrations in a community are associated with either the prevalence of angina pectoris or the natural history of heart disease. Furthermore, within communities, there is no evidence that there is a relation between the frequency of angina pectoris pain episodes and changes in the ambient carbon monoxide concentrations. Without such evidence, although the clinical experimental studies suggest important relationships between carbon monoxide and heart disease, ambient carbon monoxide cannot be implicated as a major causative factor of heart disease in a community.

It is clear from the above that the National Academy of Science's National RESEARCH COUNCIL does not think that the Aronow and Anderson studies up to 1977 were really convincing. Nor do I think they would find the Aronow 1978 and 1980 ones convincing either. According to these scientists there is no carbon monoxide caused cardio-vascular problem that can be said to be backed by solid evidence.

The EPA staff Tables 3,4, and 5..and pages 55074-55076..of the FEDERAL REGISTER show a great deal of computer work. But if there is no compelling data, and if there is therefore NO PROBLEM, then multiplying "nothing" by the estimated 7,700,000 affected individuals still equals "nothing".

D. Under the category "Effects for Human Health" (Effects on Man and Animals) p. 164, National Academy of Sciences CO report;

> "Nearly all the available data on the effects of chronic CO exposure are derived from animal experiments....Existing data neither establish nor disprove a significant influence of chronic CO exposure on human health."

9. Problems of bias towards the "higher than normal" levels of COHb in normal, non-smoking women of child-bearing age.

As a woman I am disturbed by the implication in much EPA literature that only men should be used for determining base-line endogenous COHb. For instance the study of R.B. Coburn of 1977, "Estimation of carbon monoxide production, blood phase studies in International Symposium on Chemistry and Physiology of Bile Pigments (U.S. Dept. of HEW, NIH-77-1100), is not listed in the Federal Register of August 18, 1980 that we are considering today.

As noted in the Draft EIS of the State of Montana for Ambient Air Quality (January 1979) this study of Coburn refered to the high levels of COHb in women: "A certain amount of CO is naturally produced in the body. About 1/2 of 1% (.5%)of the hemoglobin normally will be carrying such naturally produced CO. This may increase to about 1 and 1/2%(1½%) in females during menstruation." Coburn also notes that pregnant women and those who are post-partum also have high COHb.

It is implied in EPA reports that pregnant, menstruation, and post-partum women may be "at risk" in ambient air with even small amounts of CO, and so may be the fetus they are carrying. I would suggest that a more sound physiological view would be that these higher levels of COHb in the female body during special reproductive periods is normal and probably advantageous,..not abnormal and probably disadvantageous. The woman & her fetus may not be at risk!

10. Problems of bias towards the "higher than normal" level of COHb in certain men.

In EPA literature it is assumed that a non-smoking man in a clean, rural environment with a COHb above 0.5% has been "tainted" by some exogenous CO source. I do not believe this has been established by scientific data. Aronow, for example, has reported subjects with endogenous levels up to 1.5% (non-smokers). Yet the EPA is proposing that COHb of 1.5% is the beginning of the "danger level" for those people at risk. Some of these non-smoker men may normally have levels this high. And smokers are known to range from 2.5-17.0% COHb. I feel that the EPA may be using "scare tactics" involving levels as low as 9-ppm for an 8 hr. period, lest one go over the 1.5% COHb mark.

SUMMARY AND CONCLUSIONS:

The work of only one man, W.S. Aronow and his various associates in different experiments supports the stringent standards the EPA is now proposing for CO. None of the Aronow experiments has been replicated. The methodology of these experiments called "double blind" is suspect since it has not yet been proved that a subject cannot tell the difference between breathing pure air and breathing 50-100 ppm CO. Moreover, data for individual experiments is consistently "too good."

Also new concepts of arterial spasm in the heart (and perhaps in peripheral arteries) raises the problem of uncontrolled variables in some of Aronow's experiments.

A less rigid 8 hr. standard of 12-ppm is justified by the confirmed experimental data in the literature. In this regard the FINAL EIS for Montana came to the same conclusion on p. 250, it states: (1980, February)

> "The Department recommends adoption of an ambient air quality standard which will prevent blood concentrations of COHb in excess of two percent, to assure protection of the public health."

The 2% corresponds roughly to 12-ppm for 8 hours; actually the Coburn Table indicates only a 1.9% COHb.

But on p. 25 of the Final 1980 EIS for Montana it states: "Given the requirements of the Federal Clean Air Act, the Department believes that it would be pointless to adopt a standard less stringent than the current federal primary standard. Therefore the Department is recommending a standard of 9-ppm for eight hour averaging periods." In other words, even though the experts in Montana believed that the experimental data only supported a 12-ppm 8 hrs. standard, they were reluctant to challenge the EPA. Spokane is not reluctant to challenge.

A change from 9-ppm to 12-ppm is a logical and much-needed change. Spokane for example will not be able to reach a 9-ppm attainment level. Spokane could..with hard work.. attain a 12-ppm level and do so with pride and gratitude to the EPA. But even with manditory maintenance and inspection of vehicles Spokane is not going to be able to meet the 9-ppm level. A huge new level of governmeent necessary for automobile M/I is being vigorously protested throughout the U.S. since in no area where M/I was established did the area attain 100% compliance. Note that Spokane is not a high-altitude city nor one with pollutants other than CO. We sincerely believe that 12-ppm for 8 hrs. and 35ppm for 1 hour would not be detrimental to the health of Spokane citizens and it would be possible to attain these standards by 1982. (This is COHb level of approximately 1.9-2.1%).

Submitted by:

Marilyn M. Stanton
MARILYN M. STANTON

TESTIMONY

BEFORE

UNITED STATES SENATE

COMMITTEE
ON
ENVIRONMENT AND PUBLIC WORKS

CONCERNING

AMBIENT AIR QUALITY STANDARDS FOR SULFUR DIOXIDE

Seattle, Washington
June 27, 1981

William E. Pierson, M.D.

Pediatric Allergist

Co-Director, Division of Allergy
Children's Orthopedic Hospital and
Medical Center

and

Clinical Professor,
Dept. of Pediatrics
University of Washington
Seattle, Washington

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American Lung Association of Washington
American Academy of Pediatrics
American Academy of Allergy
Joint Council of Allergy and Immunology

Mr. Chairman, Senators, ladies and gentlemen, my name is William E. Pierson, M.D. and I am a pediatric allergist from Seattle, Washington.

During the last 3 years we have had the opportunity to perform collaborative studies on the adverse effects of sulfur dioxide on allergic children and adolescents. This research was done with Dr. Robert Frank and Dr. June Koenig of the Dept. of Environmental Health, University of Washington.

The studies were sponsored by the National Institutes of Health, A.S.T.H.M.A., Inc. and the Washington Lung Association after approval by the Human Subjects Review Committee, University of Washington.

The results can be summarized as follows:

(A.) Asthmatic adolescents exposed to 1ppm of SO_2 for 30 minutes at rest had significant decrease in lung capacity. (1)

(B.) The same group of subjects exposed to modest exercise had even greater decreases in lung capacity following SO_2 exposure at 1 ppm. (2)

(C.) Healthy non-allergic adolescents (8/66) had demonstrable decreases in lung function after SO_2 exposure for 30 minutes at 1 ppm, and the magnitude of change was far less than asthmatic patients. (3)

(D.) Non-Asthmatic allergic adolescents exposed to SO_2 at 1 ppm for 30 minutes had significant decreases in lung capacity. (4)

(E.) Asthmatic adolescents exposed to .5 ppm of SO_2 had same significant decreases in lung capacity as prior exposure at 1 ppm. (5)

Since 15% of the population have allergies to some degree the implications of these studies showing adverse health effects of SO_2 exposure are far broader than the small groups studied. The 2.1 million asthmatics and 10 to 12 million allergic youth in the United States are all susceptible to these lung changes. Additionally, the 60 million "healthy" or non-allergic people under age 20 will be susceptible to adverse changes of smaller magnitude.

Therefore, based on these studies of young people and the adult studies of young people and the adult studies of Dr. Homer Boushey and his colleagues, (6) at the University of California, on greater sensitivity of adult asthmatic patients, we wish the Committee to consider these new data in any changes brought about in lessening SO_2 standards.

Finally, both our findings and those of the University of California researchers, suggest a great need for short term SO_2 exposure standards to avoid adverse health effects.

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Effects of Inhaled SO_2 Alone and SO_2 + NaCl Droplet Aerosol on Pulmonary Function in Healthy Adolescents Exposed During Rest and Exercise

Jane Q. Koenig, Ph.D.
William E. Pierson, M.D.
Martha Horike, B.S.
Robert Frank, M.D.

Departments of Environmental Health and Pediatrics
University of Washington
Seattle, Washington 98195

ABSTRACT

Recently we reported statistically significant changes in pulmonary functional measurements in asthmatic adolescents exposed at rest or during moderate exercise. As an aid to interpretation of those results, we decided to repeat identical exposures in healthy adolescents. After exposure at rest to SO_2 + NaCl droplet aerosol, the healthy adolescents showed small but statistically significant reductions in FEV_1 ($P<0.05$, 03% decrease). No significant changes were seen following exposure to NaCl or SO_2 alone at rest.

Exposure to the SO_2 modes during moderate exercise produced greater changes. Following exposure to either 1.0 ppm of SO_2 + 1 mg/m^3 NaCl droplet aerosol or 1.0 ppm of SO_2 alone, the reductions in FEV_1 were slightly greater (6 %) and prolonged compared with those seen after NaCl exposure. Significant decreases also were seen in $\dot{V}_{max50}$ and $\dot{V}_{max75}$. No changes were seen following exposure to NaCl alone during exercise. However the changes seen in the healthy adolescents were slight compared to those seen in the asthmatic adolescents previously exposed (changes of 23-67%). We conclude that asthmatic adolescents are much more sensitive to the effects of inhaled SO_2 than are healthy adolescents.

Keywords: SO_2, asthmatic adolescents, healthy adolescents, FEV_1, $\dot{V}_{max50}$ and $_{75}$.

INTRODUCTION

In adolescent asthmatic subjects, a mixture of 1.0 ppm of sulfur dioxide (SO_2) and 1.0 mg/m^3 sodium chloride (NaCl) droplet aerosol produced slight changes in pulmonary function (Koenig et al., 1980; Koenig et al., 1981). Exposure was by mouth while the subjects were seated at rest. Under these circumstances the dose appeared to be close to the threshold of response. However when moderate exercise was imposed on the SO_2 exposure, dramatic functional changes consistent with bronchoconstriction occurred (Koenig et al., 1981). Moderate exercise alone had no effect. For comparison, in the present study, we exposed healthy adolescent subjects who had no signs or symptoms of allergic disease to the same pollutant mixture under identical circumstances of rest and exercise. To our knowledge no one has reported a study of the acute effects of inhaled SO_2 in a group of carefully characterized healthy adolescents.

METHODS

The subjects were eight adolescents aged 12-14 years with no signs or symptoms of allergic disease; three were female. In order to verify that our subjects had no allergic diseases or atopic predispositions we completed an extensive evaluation for any evidence of allergic (Type I) hypersensitivity. This was accomplished by a thorough clinical and environmental history and phsyical examination. In addition, the following laboratory tests were performed:

1) Examination of nasal cytology by light microscopy following differential eosinophil stain (Hansel's stain).
2) Pulmonary functional evaluation:
    a) Forced vital capacity (FVC)
    b) Forced expiratory volume in one second (FEV_1)
    c) Peak expiratory flow rate (PEFR)
    d) Forced expiratory flow ($FEF_{25-75\%}$)

    The criterion for normalcy is less than a 15% decrease on any test below predicted normal values for height and age.
3) A standardized exercise challenge treadmill test to quantitate pulmonary responsiveness to an exercise stimulus. The criterion is less than a 10% decrease in FEV_1 following 5-6 minutes of exercise at greater than 80% oxygen consumption.
4) A standardized methacholine challenge test using a Rosenthal

Dosimeter to quantitate cholinergic sensitivity to aerosolized methocholine (Chai et al.,1975). Methacholine concentration is doubled in nine steps from 0.075 mg/ml to 25 mg/ml. The criterion is less than a 20% decrease in FEV_1 or FVC at any time during the test.

5) A quantitative determination of serum immunoglobulins including E (IgE) (Berg and Johansson, 1965; Cesta and Lundqvist, 1972) and immunoglobulins G, M, and A, nephalometer method. The normal range for IgE for this age group is 0.5-120 IU/ml.

Only subjects who had normal evaluations and normal test values were included in our study. We recruited subjects from 7th and 8th grade classes at a private school. Thirty-one students responded as having no family or personal history of allergy. Nineteen were eliminated because of other answers which indicated allergic problems. Of the remaining twelve, two were eliminated due to elevated IgE levels and two were eliminated due to a positive response to the methacholine challenge test. The remaining eight subjects participated in our study. Informed consent forms approved by the University of Washington Human Subjects Committee which included a description of possible benefits and risks of participation were read and signed by all subjects and their parents.

All subjects were exposed to three different exposure modes on three separate days, usually one week apart. The three modes were:

a) Filtered air to which SO_2 + NaCl droplet aerosol were added to reach concentrations of 1 ppm and 1 mg/m^3 respectively; relative humidity (RH)$\geq$ 75%, temperature (T) ≈ 22C. At 75% RH the aerosol had a particle mass median diameter (MMD) of 0.9 μm and a geometric standard deviation (σg) of 2.0.

b) Filtered air with SO_2 at 1.0 ppm; RH $\geq$ 75%, T ≈ 22C.

c) Filtered air with NaCl droplet aerosol at 1 mg/m^3; RH $\geq$ 75%, T ≈ 22C.

As a precaution the first exercise session on the treadmill was always during exposure to the NaCl droplet aerosol alone. The sequence of exposure to SO_2 alone or to SO_2 + NaCl droplet aerosol was determined by the toss of a coin. The concentration of SO_2 was monitored by a pulsed fluorescent SO_2 analyzer (Thermo Electron Corp.). An integrating nephelometer (Meterology Research Inc.) which measures the light scattering due to the aerosol particles (G_{sp}) was used as a continuous measure of aerosol mass concentration. The complete methods for generating and monitoring the SO_2-NaCl mixture have been described previously (Koenig, et al., 1980).

All physiological measurements were recorded with an oscillograph or X-Y plotter with the subject seated in a volume-displacement body plethysmograph. The following were measured:

1) Total respiratory resistance (R_T), using the forced pressure

oscillatory technique at 3 Hz. Values were based on an average of 10 breaths.

2) Functional residual capacity (FRC), using the gas compression technique (Dubois et al., 1956).
3) Maximum flow calculated at 50% ($\dot{V}_{max\ 50}$) and 75% ($\dot{V}_{max75}$) of expired vital capacity (VC), from a partial flow-volume curve begun from approximately 60% of inspired VC.
4) Forced expiratory volume in 1.0 second (FEV_1), calculated from a maximal flow-volume maneuver immediately following the partial maneuver.

In the partial flow-volume maneuver, the subject inspired to total lung capacity, exhaled slowly to approximately 60% of vital capacity as monitored on an oscilloscope, waited 6 sec., and then expired forcefully. Reflex bronchoconstriction may be produced temporarily by deep inspirations (Nadel and Tierney, 1962); the delay at the intermediate volume was made to minimize the possible bronchoconstriction (Green and Mead, 1974).

The $\dot{V}_{max50}$ and $\dot{V}_{max75}$ tests were measured in duplicate and the FRC test was measured in triplicate. The mean value was used to assess functional changes. FEV_1 was measured in duplicate; measurements were repeated if they were not within 5% of each other. The best FEV_1 of each pair was chosen. Since many measurements were required through the session, two instead of three FEV_1 measurements were taken each time to prevent excessive fatigue of the subject.

Two sets of measurements were recorded during the baseline period which required approximately 15 minutes. Following the baseline measurements, exposure to one of the three modes was begun. Exposure was via a rubber mouthpiece; nose-clips insured mouth breathing. The first stage of exposure lasted 30 minutes while the subject was at rest, seated outside the plethysmograph. This was followed by a brief interruption of exposure (5-7 minutes) for functional measurements performed with the subject seated in the plethysmograph. The following parameters were monitored throughout exposure: minute ventilation ($\dot{V}_E$) (Hewlett-Packard respiratory integrator) and end tidal CO_2 tension (Beckman gas analyzer). The mean $\dot{V}_E$ for a 10 minute period during the 30 minute rest exposure was chosen as that subject's resting value. The second stage of the exposure lasted for 10 minutes while the subject walked on a treadmill. The speed and elevation were adjusted for each subject to produce a 5 to 6-fold increase in the mean resting $\dot{V}_E$ (~ 2.4 mph and 12% grade). On each subsequent exposure day the treadmill settings for each subject were replicated; thus the work load on each day was identical. Immediately after exercise, the subject returned to the plethysmograph for 20 minutes of nearly continuous functional measurements.

The data analysis was done in a single blind fashion; that is, the person who calculated the values for the functional parameters did not know the mode of exposure on any given experimental day. The paired t statistic was used as a test of significance on the grouped data for each functional parameter (Snedecor, 1966). The two sets of baseline values were combined in a single mean which was then tested against the mean at the end of 30 minutes (after exposure at rest) and against values obtained sequentially during the 20 minutes following exercise.

A symptom rating scale was scored by the subject at the end of the experiment for cough, substernal pain, laryngitis, wheezing, dyspnea, fatigue, headache and nasal discharge. The form was taken home and scored later that day and on the following day.

RESULTS

Values for the pulmonary functional measurements during the three exposure modes are given in Table 1. The degree change, variability and time course of change for four of the functional measurements (R_T, $\dot{V}_{max50}$, $\dot{V}_{max75}$, and FEV_1) were similar. Therefore graphic representation of FEV_1 changes during exposure are provided as representative of the effect seen (Figure 1).

Exposure at rest:

The mean decrease in FEV_1 from baseline following 30 minutes of exposure at rest to 1.0 ppm of SO_2 + 1.0 mg/m^3 of NaCl droplet aerosol was statistically significant (03% decrease, $p < 0.025$, Figure 1). The changes in R_T, FRC, $\dot{V}_{max50}$ and $\dot{V}_{max75}$ during exposure to the SO_2 + NaCl mixture at rest were not statistically significant. There were no statistically significant changes in pulmonary function following 30 minutes of exposure at rest to the NaCl droplet aerosol alone or SO_2 alone.

Exposure during exercise:

NaCl alone:

Following exposure to the NaCl droplet aerosol alone during exercise, there was a small mean decrease in FEV_1 (4%) which was not quite statistically significant ($t = 2.11$, $df = 7$). Also changes in R_T, FRC, V_{max50} and V_{max75} during exercise/exposure to NaCl alone were not statistically significant.

SO_2 alone:

The mean decrease in FEV_1 from baseline 2-3' after exposure to SO_2 alone during exercise was statistically significant (06% decrease, $p < 0,001$, Figure 1). The only other point when the mean decrease was statistically significant was at (7-8') post-exposure (5% decrease, $p < 0.05$). The decreases in $\dot{V}_{max50}$ and $\dot{V}_{max75}$ at 7-8' post exercise/exposure were statistically significant (8% decrease, $p < 0.05$ and 12% decrease, $p < 0.025$ respectively). The changes in FRC and R_T were not statistically significant.

SO_2 + NaCl:

The decreases in FEV_1 2-3' and 4-5' after exposure to the SO_2 + NaCl mixture during exercise were statistically significant (6% decrease, $p < 0.005$ and 3% decrease, $p < 0.050$ respectively, Figure 1). The decrease in $\dot{V}_{max50}$ 4-5' post exercise was statistically significant (8% decrease, $p < 0.025$). FRC values increased by 10%, a change which was statistically significant ($p < 0.05$). The changes in $\dot{V}_{max75}$ and R_T were not statistically significant.

There were no consistent responses on the symptom rating scale and no report of subjective symptoms during or after any of the three exposure modes.

DISCUSSION

In Table 2, we have compared the average percentage change in pulmonary functional values after exposure to SO_2 + NaCl droplet aerosol during moderate exercise between two groups of subjects; adolescents with asthma and adolescents with no allergic diseases.

The results support the hypothesis that asthmatic adolescents are more sensitive to the inhaled effects of an air pollutant than adolescents who do not have asthma or other allergic diseases. It is true that the healthy adolescents showed statistically significant changes in pulmonary function after exposure to either SO_2 mode during exercise. However, the average percentage change was small (05-10%). The average percentage changes in the asthmatics were from 3-22 times greater than the changes in the nonallergic adolescents for each of the parameters used. Also, none of the healthy adolescents reported subjective responses to the SO_2 exposures; the asthmatics reported shortness of breath and wheezing.

Nevertheless it should be emphasized that 1.0 ppm of SO_2 did produce a response in the healthy group. In spite of the fact that our adolescent subjects were free of any detectable allergic disease which is associated with hyperactive airways, exposure to the SO_2 + NaCl droplet aerosol for 30 minutes at rest was associated with a statistically significant fall in FEV_1.

The addition of exercise was associated with similar small decreases in FEV_1 which were more prolonged than those seen at rest. Also following exercise during either the SO_2 + NaCl droplet aerosol or SO_2 alone exposures, significant reductions were seen in $\dot{V}_{max50}$ and $\dot{V}_{max75}$. This suggests that the sites of deposition were more extensive following exercise than at rest. It may be that the effects of SO_2 + NaCl droplet aerosol at rest were seen in the large airways alone (changes in FEV_1) while the effects of either SO_2 mode during exercise were seen in both the large and small airways. ($\dot{V}_{max50}$ and $\dot{V}_{max75}$ are functional tests assumed to reflect the calibre of the small airways.)

There were no apparent differences between the pulmonary functional effects of the SO_2 + NaCl droplet aerosol and the SO_2 gas alone. We conclude that exposure to either SO_2 + NaCl droplet aerosol or SO_2 alone elicited a slightly greater pulmonary functional change than that due to exercise alone (the NaCl control). Our results show that 1.0 ppm of SO_2 is above the threshold dose for this group of health adolescents which should be as resistant as any group to the effects of air pollutants.

The second conclusion we make is that many volunteer subjects who describe themselves as non-allergic actually display some characteristics of allergic disease. From an initial group of 31 potential volunteers, we ended up with a study group of eight. Our experience emphasizes the importance of laboratory screening tests as well as complete medical histories. Of the 12 volunteers selected on the basis of personal history, four were eliminated after laboratory screening (two subjects had IgE values outside the normal range and two had a greater than 20% drop in FEV_1 during the methacholine challenge test). A total of 23/31 (74%) of the original applicants were eliminated due to signs of allergic disease or hyper-reactive airways.

CITY OF SPOKANE, WASHINGTON

SPOKANE
ALL-AMERICA CITY
Ron Bair
Mayor

June 12, 1981

The Honorable Slade Gorton
U.S. Senator
127 D Russell Senate Office Building
Washington, D.C. 20510

RE: SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS - HEARINGS ON THE CLEAN AIR ACT

Dear Senator Gorton:

I would like to thank you for this opportunity to submit the City of Spokane's comments to the Senate Committee on Environment and Public Works for its review. As you know, the City has been quite concerned for some time about the contents and administration of the Clean Air Act and welcomes this Congressional review.

Mrs. Marilyn Stanton of the Spokane County Air Pollution Control Authority Board will be submitting detailed technical comments concerning the current Carbon Monoxide Ambient Air Quality Standards to your hearing on the 27th. Therefore, these comments will deal in more general terms.

In early March we received the report from the National

Commission on Air Quality containing its recommendations for changes in the Clean Air Act. In broad terms we agree with the concepts contained in those recommendations. However, there are three areas where the City must take exception.

Under its recommendations pertaining to the Nonattainment Program, number 47 indicates those areas that have an approved State Implementation Plan (SIP) should implement that Plan on the schedule specified in the Plan. Under number 52 the Commission indicates that a new 3 year review process should be substituted for the 1982 and 1987 deadlines for meeting air quality standards. The recommendation goes on to state though, "This change does not affect approved dates of compliance for sources in state implementation plans."

The City's concern with this recommendation is that those states that complied with the existing Clean Air Act are being penalized over those that dragged their feet and didn't. This is similar to the Sewer Construction Grant Program under the Clean Water Act that gives money to local governments that have done nothing to protect the water and tells those that have, "Sorry, your don't have a big enough problem for financial help."

The second area where the City of Spokane objects to the

Commission recommendations is under item 77 which states that the final statutory carbon monoxide automobile standard of 3.4 grams per mile should be changed to 7.0 grams per mile. Without an equivalent increase in the National Ambient Air Standard for Carbon Monoxide (CO) this recommendation will be disasterous.

All the strategies in the local SIP's and the projected percent reduction in CO are based on a computer modeling using the 3.4 grams per mile. To arbitrarily increase the number to 7.0,will mean there is no way our expected strategies can beat the standards. With this sudden change in the rules it will mean any city that used the existing 3.4 grams/mile will be in violation and be forced into the mandatory Inspection/Maintenance Program. It has not been shown anywhere in the nation where the mandatory inspection/maintenance program has achieved the results predicted.

What is needed to coincide with the increase in the auto emmission level is a corresponding increase in the National Ambient Air Quality Standard for Carbon Monoxide from 9 parts per million to 12 parts per million. The City contends that this is the one change in the Clean Air Act that must be mandated by Congress, not EPA.

The present standard of 9 ppm is a regulatory over-kill without adequate technical support for protection of the general public. A level of 12 ppm is just as protective as is 9 ppm without the enormous cost to the local economy. As already mentioned, Mrs. Stanton will be submitting technical backup for these statements on the 27th of June.

The final area of concern is the National Ambient Air Standards for Total Suspended Particulates. In 1979 the City was informed that EPA was beginning to formulate a new Inhalable Particulate standard. This would replace the existing TSP standard because the fine particulates are what enter the lung and create health problems. The City agrees with this approach and anxiously awaited the new numbers. It does not appear that EPA is able to develop numbers in an expeditious manner. This could leave Spokane and many other cities with a serious problem for compliance. We are surrounded by bountiful farmlands in our fair City. However, the prevailing winds are from the southwest where they pass over thousands of acres of wheat fields before they drop their heavily laden dust load onto Spokane. The City has no jurisdiction over the farmlands nor the natural phenomenon of wind blown dust. Therefore, the City recommends that the Clean Air Act be amended to exempt areas such as ours from TSP standards that are unrealistic for our situation.

Thank you again for this opportunity to comment and we look forward to your positive Congressional response. I would appreciate being kept informed of the activities in Congress concerning the Clean Air Act.

Sincerely,

Mayor

ks

Honorable Slade Gorton
U.S. Senate (chairing Senate Environment & Public Works Comm.)
Washington D.C. 20510

1981 JUN 29 PM 4: 34

June 25, 1981
Brad Carlquist
1252 N.W. 116th.
Seattle, Washington
98177

Dear Senator:

I'm here today to testify in support of a strong Clean Air Act. An act which will protect both the public health of our citizens and the visual air quality of our atmosphere. Today we are focusing in on those changes which will affect the visibility in and around our National Parks and Wilderness Areas.(Please include in hearing record)

Here in Washington State we still have occasional spectacular vista's of natural treasures; Mt. Rainier , Olympic N.P., along with views of the Cascade mountains. These vistas and our relativly clean air are what make the quality of our life here in Washington State. These views are even difficult to view from the Puget Sound lowlands due to the deteriorating air quality and weather/smog systems. Many urban areas do not have sufficient clean air for their citizens to breathe. In the Pacific Northwest we have been fortunate to have relatively clean air to breathe and a healthy air quality which enable our citizens a view of our National Parks and Wilderness areas. We must ensure this Air Quality. We must not allow Class 1,2,3 air quality standards to be weakened. In fact we should strenghten our air quality standards.

I have been a citizen in Washington State for 28 years and have noticed a gradual and sometimes rapid loss of air quality in our urban areas and in and around national parks and wilderness areas. Having worked as a Park Service Ranger, Forest Service Ranger and Corp. of Engineer Ranger in the Northwest I have managed lands, resources, and public on public lands. I'm very concerned about the current Administrations lack of commitment to adequately protect our parklands, its air quality and visibility. Part of the problem over the years has been regulations which are not clean enough and inadequate to protect air quality, their interpretation and implementing problems, and balancing environmental costs and benefits with energy.

Congress amended the Clean Air Act in 1977 (Sec. 169a) to protect the visibility of Federal Class I National Parklands. Congress has stated that "Federal land manager of the lands should assume an aggresive role in protecting air quality values of land under his jurisdiction". Congress thus designated primary responsibility to protect the air quality and related values of class I lands to the Federal land manager. This is an important provision, for it gives the actual land manager input into the decision process.

The Clean Air Act is of vital importance to the National Park Service. Without it the visitors enjoyment of the park would be greatly diminished and the resource itself would be threatened. Air pollution clouds scenic vistas, air pollution threatens irreversible harm for entire ecosystems in the park and wilderness lands. Acid rain has caused damages to the vegetation and man made facilities, water within parks and wilderness areas. Over the years the Clean Air Act has brought about significant reductions in major pollutants and stimulated rapid innovations in pollution control.. However many of our park and wildland areas are now endangered by air pollution and many areas of the country have yet to attain even minimal air quality and many pollution problems exist ie.(acid rain, toxic air contaminants). The recently published 1980 National Park Service Report, "State of the Parks" has noted that, nearly half of the parks are threatened and endangered by air pollution problems. Clean air and the Parks however cannot be separated from the conditions of the rest of the environment. Boundaries of our parks and wilderness areas cannot be all encompassing they are only imaginary lines. Parkland boundaries can not by themselves be a deterant to sucessfully preserve the visual and air quality of the area. Parks and wilderness areas are our 'islands of hope' and must be given our strongest protective measures if we are to retain them in a quality state.

Congress must adapt strengthening amendments on acid rain, fine particles andtoxic contaminants, and the resulting visual quality standards which result. Instead Congress is presently considering weaker and less strict standards (?).

I am very concerned over these key issues: I have Listed Above Reasons.

The National Ambient Air Quality Standards, (NAAQS): These were set in order to set limits for major pollutants in order to protect public health. I do not believe that these (NAAQS Standards) should be weakened to only protectthe general pop.-asindustry recommends, but they should be set to protect people who are highly susceptible to resp. problems caused by air pollution. Industry groups claim that these standards should be weakened via cost/benefit analysis. They claim that weighing benefits against cost of controls should be employed. Well the point is here that air pollution is difficult to measure, moreover resp. problems in most cases are long term and the full range of costs and benefits have not been explored and studied to say nothing of the esthetic problems/benefits.

Prevention of Significant Deterioration: Protecting the pristine air associated with National Parks, Wilderness Areas and Natural areas where the air quality is Class 1. Under the prevention of significant Deterioration Program (PSD) the following types of air sheds : Class 1 - Pristine areas such as National Park lAnds, Class 2 - areas which could be polluted to a certain moderate level, and Class 3 - areas that allow even a greater increase in pollution. Complaints from industry of regulatory delay and incremental program are unfounded. Permits have been allowed in nearly all cases unless there are warrented reasons for rejection.

The National Academy of Sciences in a recent review of PSD program, support the program and point to the fact that 75% of PSD permits have been issued in 10 months or less and 100's of permits have been issued since the program began in 1977. They also point to the fact that PSD program has had very beneficial results in 'forcing' the development of innovative cost-efficient pollution control technologies.

Integral Vistas: The National Parks should recieve special air quality protection. Views from the parks should be protected as class I visual standards. The N.P.S. has identified 182 integral vistas assoc. with parks across the U.S. where special protection is needed to protect the scenic and scientific resources. Vistas are of great value because if you can't see an area to enable yourself to understand how or why an area was formed you can't enjoy it, learn from it, or be inspired by it. National Parks were established for a reason and each park had scenic views which they were established for.

Park Managers should have the ability to state reviews of new pollution sources outside park boundaries. Managers should have input in these decisions concerning the welfare of their park they are managing for the public and the adverse effects of degrading air quality. After all the decision on integral vista's to protect a vista lies with the affected state. The program only gives the Park Manager input into the decision making process. I don't believe we should allow the Integral Vistas provision to be weakened.

Acid Rain: Acid Rain is causing damage to parklands and wilderness Class I airsheds which inturn are degrading the ecosystem. SO2 emissions and NOX nitrogen oxide compounds are causing billions of dollars of damage a year and increasing in their scope. Acid rain is especially a problem here in the Northwest and Western region of the U.S. It is also a problem on the east coast, and has lead to severse problems for parklands and cities and public in these areas. Acid rain can be produced in one locality and cause an effect 100's of miles from it's original source.

Toxics: Industry shouldn't complain about hazardous pollutent standards for toxins because out of the more than 100 dangerous toxins EPA has only implemented hazardous pollutand standards for 4.

Fine Particulates: Fine particulates contribute to visibility impairment and serious lung diseases. Particulates such as sulfates, trace metals, nitrates, organic compounds, and fine particulates are responsible. Ground level air quality problems caused by high level of locally generated and concentrated pollutants cause effects much further from their source. Long range transport of pollution : Acid Rain, smog, particulates are all linked to pollutants traveling long distances through the atmosphere. and contributing greatly to loss of air quality and loss of visibility.

Our government energy hunt on public lands should not sacrifice our natural wonders! Utilities and minning companies search for minerals and petrolum perserves upon public lands esp. national parks, wilderness areas, wildlife refuges, and roadless areas should not be damaged for the sake of marginal resources at the sake of more long term resources. The net result (if allowed) will be layers of smog and pollution and loss of Class I vistas over much of this country's scenic wonders. The southwest where vistas of the Grand Canyon and red rock areas have been common are being lost. One fifth of the entire NPS lands will be affected here by planned strip mines, coal-fired power plants and loss of air quality.

National Parks are islands of nature pressed in on many sides by civilization. National Parks are more valuable to us with time as a relief and spiritual, scientific , educational lab and recreational area. As we develope more and more lands our parks and preserves become even more important, we must not degrade their quality. Will we destroy the parks too in our quest for productivity and world arms race ? If we do, we will be a much poorer nation and make this nation and the world a worst place to live.

Air quality currently endangers half of the N.P. system units. The significance of the proposed regulation extends beyond scenic quality but would also assist prevent broader ecological damage from the same pollutants. Fine particles like sulfates that aborb light and thus impair public visibility can lead to acid precipitation. Currently there are 182 Class I areas (national parks & wilderness areas) in which visibility should be protected under section 169a of the Clean Air Act amendments.

The state must work with the federal land manager of the area to assure the visibility and standards are met. More teeth should be used in regulations to protect integral vistas. Areas which are outside park boundaries but viewed from within the park are important to the visitor's experience of the park and are some of the reasons for which the park area or wilderness was first created. Regulations should be explained to include essential vistas viewed from the outside of the park. Agencies who are in charge of the Class I areas should be making the determination of which areas are integral vistas and final judgment should be made on the basis of preserving the resources rather than just the energy or economic consideration.

I would like to see a better defined and aggressive role for the N.P.S. and other federal land managing agencies in implementing visiability protection for their own Class I areas of existing and new sources. Recently the National Park Service has identified 20 units of the N.P. system which are suffering visibility impairment from energy development sources. None of these are affected by EPA's visability protection regulations !!! Changes are definate need of changing, and need not to be weakened, as industry is lobbying for.

These units include: Bryce, Canyonlands, Capital Reef, Arches, Chiracahua, Dinosaur, Everglades, Glen Canyon, Grand Canyon, Great Smoky Mts., Mesa Verde, Navaajo, Natural Brides, Petrified Forest, Sequoia- Kings Canyou, Sunset Crater, etc. Also 63 units are adversely affected by proposed energy facility develoment in the vicinity. The N.P.S. has received many energy production facilities. In 1980 the N.P.S. received 25 P.S.D. applications and in only 1 instance did N.P.S. file an objection with EPA. It is important to note the threat of potential pollution sources to the parks and the urgent need to prevent visibility impairment from these sources. Development and utilization can many times still take place by fair balancing of environmental, energy, social, health, economic, and park resource factors.

The Reagan administration has frozen the integral vistas guidlelinds. I do not believe the energy development should lead us into a blind alley exploiting even our Class I air sheds of natural wonders ; our National Parks and Wilderness areas. Scenic views and visibility protection are of vital importance to our nations parks and people.

Currently our National Parks are not being adequately protected because laws are not strong enough, regulations not clear enough, lack of the NPS. agency input into process, and lack of commitment by the administration to perpetuate the values upon which the National Parks and Wildernesss Act were established upon. I rest my case. Thank-you for the opportunity to hopefully influence government and ultimately protect the Strongest Clean Air Act obtainable .

Please make sure my comments are added to the hearing record. I have been unable to participate in the hearing due to my service to the public as a Park Ranger this June 27. 1981. Thank-you again.

Sincerely yours,

Brad Carlquist

Brad Carlquist

Council Of Energy Resource Tribes
1140 Connecticut Avenue, N.W.
Suite 310 • Washington, D.C. 20036
(202) 887-9155

Executive Committee

Peter MacDonald
Chairman
Navajo

Wilfred Scott
Vice-Chairman
Nez Perce

Leonard Atole
Secretary
Jicarilla Apache

Allen Rowland
Treasurer
Northern Cheyenne

Leonard Burch
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Fort Hall
Fort Peck
Hopi
Jemez Pueblo
Kalispel
Rosebud Sioux
Salish Kootenai
Santa Ana Pueblo
Spokane
Uintah-Ouray
Yakima
Zia

Executive Director
Ed Gabriel

July 16, 1981

The Honorable Slade Gorton
U.S. Senate
Washington, D.C. 20510

Dear Senator:

Attached is a copy of the testimony on the Clean Air Act that the Council of Energy Resource Tribes (CERT) submitted for the record.

In its testimony and by resolution of the Board of Directors CERT has recommended that the Clean Air Act be amended so that Indian tribal governments be explicitly authorized to implement the Act on Indian land and that tribes be eligible for implementation assistance. CERT's recommendations closely parallel those of the National Commission on Air Quality, regarding Indian tribes.

On behalf of the 26 energy owning Indian tribes that belong to CERT I request your support for CERT's recommendations.

Sincerely,

Ellen S Brown for
Lucille A. Echohawk
Director, Office of Policy Analysis

Testimony on the
Clean Air Act for the Senate Committee on
Environment and Public Works

Submitted by the
COUNCIL OF ENERGY RESOURCE TRIBES
July 15, 1981

The Council of Energy Resource Tribes (CERT) is pleased to have the opportunity to submit testimony on the Clean Air Act. CERT is a coalition of 26 Indian tribes that own substantial energy resources. Our goal is to assist the tribal membership develop the capability to manage their resources to bring about economic prosperity on the reservations.

Last year Indian tribes produced nearly a million barrels a day of oil equivalent. The potential for further energy development on Indian land is tremendous. Energy development can mean jobs, income and tribal revenues, all of which are badly needed prerequisites to tribal economic development. But energy development can also mean environmental degradation.

Environmental quality is particularly important to Indian tribes. The reservations are considered homelands to be protected and preserved for future generations. The maintenance of a tribe's limited land base is essential if the tribe is to achieve lasting economic prosperity. For Indian tribes the land is their major tangible asset tying the people to their traditions and their history.

Controlling the environment of Indian reservations is, therefore, a major concern of CERT. Indian people look to their elected tribal governments to provide for their general welfare. The Clean Air Act should be revised to enable tribal governments to exercise control over air quality on their reservations.

The Act is silent as to whether tribal or the federal government is to design and implement programs to achieve national air quality standards on Indian reservations. States cannot assume authority because Indian tribes are not, as you are probably aware, political subdivisions of states, as are local governments (see United States v. Wheeler, 435 U.S. 313, 329 (1978)).

Nor would it be appropriate for states to be given authority to implement the Act on Indian land. Federally recognized Indian tribes have a direct relationship established by Treaty or Executive Order with the federal government. "Indian tribes are unique aggregations possessing attributes of sovereignty over both their members and their territory." (See U.S. v. Maguire 410 U.S. 544, 55.7 (1975)). Because the Clean Air Act did not delegate authority to either tribal governments or the federal government no one has clear authority under the Act on Indian reservations.

It was certainly not the intention of the bill's drafters to leave any area of the country uncovered by the Act. Several tribes have attempted to fill the gap. This year ten tribes have received assistance from EPA to begin to develop air quality monitoring programs. CERT is assisting those tribes in this effort. But the financial and technical assistance given to state governments remains unavailable to tribes. Without adequate assistance tribes, like states, lack the resources to develop full regulatory programs.

To leave authority on Indian land unclear is unsatisfactory to all involved. It can lead to intergovernmental conflict that will take court action to resolve. It leaves industries located on Indian land with no guidance as to how they are to comply with the Act. It leaves tribal governments without the means to exercise the mandate vested in them by their people.

The Board of Directors of the Council of Energy Resource Tribes passed a resolution in March of this year that reflected their concern about the lack of recognition in the Clean Air Act of tribal governments (attachment). The CERT resolution calls for tribal authority to implement all sections of the Act and technical and financial assistance. Based on that resolution CERT recommends that Congress amend the Act so that it is clearly stated as to how it will be implemented on Indian land. Further the Environmental Protection Agency (EPA) should be authorized to delegate authority for implementing all provisions of the Act on Indian land to tribal governments when a tribal government so requests and meets the necessary requirements. When a tribe is not able to assume implementation responsibilities EPA should have authority over all existing and proposed sources on Indian land. Furthermore, tribal governments should be explicitly eligible for technical assistance from EPA and Section 105 grants for planning, enforcement and training programs. CERT's recommendations are identical to those of the National Commission on Air Quality regarding Indian lands.

By incorporating these recommendations as amendments to the Clean Air Act, the Act's deficiency with respect to Indian lands would be corrected in a manner that is consistent with the historic relationship between Indian tribes and the federal government. This solution would recognize the proper role and responsibility vested in tribal government by their citizens to protect their land and people.

Part C of the Act on "Prevention of Significant Deterioration of Air Quality" does authorize Indian tribes to redesignate lands within their boundaries to Class I or III. This treatment of tribes is appropriate and CERT urges that it be maintained.

We hope that Congress will take action to amend the Act so that it will, in its entirety, recognize the appropriate role of Indian tribal governments. We believe that our recommendations are in the interest of sound public policy and environmental health and certainly the interest of Indian tribes striving to exercise their rights of self government. CERT's recommendations would ensure that tribal governments have the authority and the means to manage their air quality for the benefit of present and future generations of Indian people.

COUNCIL OF ENERGY RESOURCE TRIBES
RESOLUTION NO. 81-5
CLEAN AIR ACT AMENDMENTS

WHEREAS, the Clean Air Act provides for the regulation of air quality nationwide, including Indian lands; and

WHEREAS, the Congress is in the process of reauthorizing and amending the Clean Air Act; and

WHEREAS, the Clean Air Act correctly authorizes the governing bodies of Indian tribes to designate their lands for the prevention of significant deterioration, but is silent on tribal authority and opportunities under the remaining provisions of the Act; and

WHEREAS, the development of needed tribal air quality regulatory programs has been impeded by the ambiguities in the current law; and

WHEREAS, Indian tribes must have the regulatory and financial options afforded by the Act to control energy and other natural resource activities on Indian reservations effectively; and

WHEREAS, the National Commission on Air Quality has recommended that the Congress amend the Act to explicity address the authority of Indian tribes under the Clean Air Act;

NOW THEREFORE BE IT RESOLVED, that the CERT Board of Directors hereby urges that the new amendments to the Clean Air Act include the following essential elements:

1. Provisions which afford tribes the option of assuming full regulatory authority for implementing all provisions of the Act on Indian lands;

2. Provisions for funding tribal development, administration and enforcement of tribal air quality programs under the Clean Air Act; and

3. Provisions for training and educational programs to assist tribes in acquiring skills and capabilities needed for air quality regulatory programs.

CERTIFICATE

The undersigned Chairman and Secretary of CERT hereby certify that the above resolution was adopted by the Board of Directors of CERT at a meeting of said Board duly called, held the 10th day of March, 1981.

81-5-1

Chairman

Secretary

The Mountaineers
719 Pike Street • Seattle, Washington 98101 • (206) 623-2314
BRANCHES IN TACOMA, EVERETT AND OLYMPIA

July 6, 1981

JUL 10 1981

Senator Slade Gorton
2988 Federal Building
915 Second Avenue
Seattle, Washington 98174

RE: CLEAN AIR REGULATIONS

Dear Senator Gorton,

The Mountaineers is the largest outdoor organization in the Northwest with more than 11,000 members. Since 1906 our members have climbed, hiked and backpacked in the state of Washington. Our organization has been instrumental in establishing the Olympic National Park, the North Cascades National Park, and other wilderness areas.

We are presently very concerned about changes that would weaken the Clean Air Act in Class I, no degredation areas. Air pollution diminishes the visitors enjoyment of parks at the same time as it alters the natural state and threatens to destroy park resources. Air pollution clouds scenic vistas, damages vegetation, and threatens irreversible harm to entire ecosystems. In writing the Clean Air Act, Congress recognized the value of regions of pristine air associated with national parks and other natural areas by making the protection of the air quality in these regions a special priority. The original intent of the Act must not be compromised.

We have some specific concerns about some proposed changes.

There has been talk of eliminating the concept of integral vistas. Most legislative acts establishing National Parks specifically identify the protection of scenic views to the outside from within the parks as a central purpose of the park. Park managers should participate in state reviews of new pollution sources outside the parks. This would not, as some have claimed, give them veto power over industry around parks. The decision on how to protect a vista still lies with the state.

We are concerned about plans to eliminate the short term maximum for pollution standards in favor of only annual averaging. Short term standards to date have been established by health criteria. It is known that these pollutants can effect vegetation over short and long terms. The short term standards should not be eliminated until such time as short and long term effects can be adequately determined.

Another specific concern is the proposition to eliminate the possibility of adding any new areas to Class I designation. This would mean no future protection for Washington State Parks, for RARE II areas, for Mt. Baker Ski areas, and other lands that currently do not have Class I protection. We must be able to regulate air quality in these areas in the future.

We oppose the amendment which gives new industry the right to violate Class I areas if it can be shown that there are offsetting environmental and economic benefits. There is no reason why new industry should be exempt from regulations with which existing industry is already in conformance.

There are proposals to relax sulphur dioxide emission standards. It is important to recognize that the accumulation of sulphur dioxide in the atmosphere and in our lakes as a result of acid rain is cumulative. The acidity of the Alpine Lakes is continually increasing now. Every relaxation of sulphur dioxide standards aggrevates the acid rain problem.

The health of our parks cannot be separated from the condition of the rest of the environment: their boundaries are, after all, only imaginary lines on a map. A provision should be made to provide a buffer of sufficient size to insure maintenance of the no-degredation areas.

We appreciate the opportunity to make these comments. Congress acted wisely in setting aside special natural areas for protection from air pollution. That special protection must not be jeopardized. Together we must assure the preservation of the parks and wilderness areas which are our unique heritage in the Northwest.

Sincerely yours,

AJ Culver

A.J. Culver
President, The Mountaineers

AJC/jrg

copies to: Governor John Spellman
Mr. Don Moose
Senator Robert Stafford

SEATTLE CONSUMER ACTION NETWORK

312 Lowman Building • Seattle, Washington 98104
(206) 623-6650

1981 Jul 7

Hon. Slade Gorton
U.S. Senate
2988 Federal Bldg
Seattle WA 98104

Dear Senator:

The attached "Post-Intelligencer" editorial expresses our feelings about the Clean Air Act as well as anything could. We only want to add that clean air may prove to be not only healthier than dirty air, but also cheaper. Since the public mood these days is "no free lunch", it is only appropriate that polluting industries and their customers (including motorists) pay for cleaning up their activities, rather than ask the public to subsidize them through excessive medical and other costs. Moreover, any injury that cannot, by its nature, be financially compensated should not be allowed to occur in the first place. We will be grateful for anything you can do to make the air worth sharing.

Respectfully,

Steve M Benn, Jr
Steven Benn, Transit Committee Chair
Seattle Consumer Action Network

[From the Seattle Post-Intelligencer, June 27, 1981]

PAY THE PRICE FOR CLEAN AIR

There was an unlucky character in the comic strip L'il Abner, named Joe Bfsptlk who was accompanied always by a small black cloud that floated above his head. If we had the power, we would summon up one of those black clouds formed of smog and float it over Sen. Slade Gorton's head when he holds a public hearing on the Clean Air Act here today.

The cloud would be a visible reminder of the invisible pollutants that poison our lungs with every breath we take. We brag about our scenic beauty and livable city but we're not proud of our rating as No. 12 in the country on the dirty air scale.

On some sunny days, particularly when there is a temperature inversion that puts a lid on pollutants, the smog drops like a curtain around the central business district. Those most vulnerable—children, old people and others with chronic heart and lung trouble, anyone exercising vigorously—cough and wheeze and gasp for air. Most of the nasty stuff that dirties the air downtown comes from automobile exhaust fumes.

Sen. Gorton is a member of the Senate Environment and Public Works Committee, the panel charged with rewriting the clean air law. The committee is feeling pressure to relax standards. Pollution control equipment is too expensive, industry argues. On Thursday, the top five domestic automakers told the senators that emission limits on new cars could be eased without harming anyone. Ford Motor Co. estimated that amending the Clean Air Act on this point would save consumers $80 a car; General Motors, more generous, pegged the savings at $360.

The argument is the same as it has been since the original Clean Air Act was passed in 1963. How much are we willing to pay for cleaner air, for better health? Is $80 too much? $360? How about 50 cents for bus fare to eliminate one car's worth of pollution from downtown?

The stakes run much higher for industry such as pulp mills, smelters and coal plants. How many millions is it worth to curb the deadly acid rain that's killing lakes and trees? To prevent lead poisoning in children?

Many scientists believe that air pollution contributes to three major diseases that kill millions every year—heart disease, lung disease and cancer. What is the right price to save a loved one from cancer

Our message to Sen. Gorton is that we would pay almost anything to avoid going through life threatened by the black cloud over our head.

CLEAN AIR ACT OVERSIGHT

TUESDAY, JUNE 30, 1981

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
Randolph Center, Vt.

The committee met at Judd Gymnasium, Vermont Technical College, Randolph Center, Vt., at 12 noon, Hon. Robert T. Stafford (chairman of the committee) presiding.

Present: Senator Stafford.

OPENING STATEMENT OF HON. ROBERT T. STAFFORD, U.S. SENATOR FROM THE STATE OF VERMONT

Senator STAFFORD. The U.S. Committee on Environment and Public Works will kindly come to order.

I am pleased to welcome the panelists who have been willing to come up here, over some distances in many cases, and welcome all of you as our guests to this hearing.

In view of the large number of witnesses that will appear this afternoon, we are going to have to follow the same procedure we have in Washington, of asking witnesses who have statements that will run more than 10 minutes to limit their oral testimony not to exceed a 10-minute summation; and those who will appear tonight, we are going to have to limit to, preferably, 2 or 3 minutes, but not to exceed 5 minutes at the outside.

Today's hearing is the fifth in a series held by the Environment and Public Works Committee on the clean air issues outside of Washington, D.C.

Others have already been held in Billings, Mont.; Casper, Wyo.; Augusta, Maine; and Seattle, Wash.

Probably the only law more complex and pervasive than the Clean Air Act is the Internal Revenue Code. It is for this reason that as chairman of the Committee on Environment and Public Works, I have sought to hold hearings outside of Washington. At this hearing, I hope we can focus on the issue of interstate air pollution, which is of major interest to New England as a whole, and to Vermont in particular.

Vermont, like our sister States in New England, suffers from the pollution of other States more than from pollution generated within our State itself.

The purpose of this hearing is to determine the scope and seriousness of the interstate air pollution problem.

We hope to also examine possible solutions as well. Of course, acid rain is one manifestation of interstate air pollution, but it is by no means the only manifestation, and it may not be the worst. At this time tomorrow, Senator Moynihan, also of our committee, will be chairing a hearing in Albany, N.Y., to examine the narrower issue of acid rain.

An earlier hearing on this subject was chaired by Senator Mitchell of Maine in Augusta.

For this hearing, I hope we will examine all pollutants: sulfates, which cloud the air; ozone, which can affect the lungs and so on. I have arranged a rather ambitious hearing. I think I should say my staff has arranged a rather ambitious hearing with many witnesses. So I reiterate that at this session, which is scheduled to run 5 hours, that we will have to ask witnesses to hold themselves to 10 minutes.

We are particularly grateful, as I said, to the witnesses that have traveled some miles to be with us.

This evening, we will have a hearing of a different sort, more like a town meeting, Vermont style. That will give private citizens an opportunity to attend and tell us their views on the Clean Air Act and its application. The evening is reserved especially for private citizens, and if time remains after they have been heard, we will take testimony from any organizations who wish to make a short additional statement.

Some persons have called my office to say they wish to testify. For those who did not call, there is an assignment sheet outside this hearing room. Witnesses will be called in the order in which they registered. Since we have a full day ahead of us, we are going to start at this point.

At this point, since I understand the Governor is unavoidably absent, we are very pleased that Mr. Brendan Whittaker is here for the Governor. Although he will speak later in his own right, I would invite Mr. Whittaker at this point as the Governor's representative to say a few words. I might say that this is rather a nostalgic spot for me. I delivered a couple of commencement addresses in this hall in the past, and engaged in some debates in political campaigns here as well.

As I said, Mr. Brendan Whittaker is here at this point, representing the Governor. A little bit later, he will be representing himself, and I will introduce him and his title at that time. But now, for the Governor, Mr. Brendan Whittaker.

STATEMENT OF BRENDAN WHITTAKER, REPRESENTING HON. RICHARD A. SNELLING, GOVERNOR, STATE OF VERMONT

Mr. **Whittaker**. Thank you, Senator.

I want formally to say the Governor regrets that he can't be here and he asked me to read this for him.

Good afternoon Senator Stafford and members and staff of the Committee on Environment and Public Works. We welcome you all to Vermont, and I appreciate the opportunity to present this statement of my views on matters surrounding the Clean Air Act. I am sorry I cannot be with you in person, for the matters you are discussing are of great importance to Vermont. I have asked Secretary Whittaker to present my statements, and for him and his appropriate staff to be available to you for additional information.

Over a year ago, Vermont established a task force of professionals to follow the acid rain issue, and the environmental agency began measuring the pH of rain and snowfalls. In addition, regular surveys of 25 selected lakes and ponds around the State were begun to measure their acidity and buffering capability. We are concerned at what we are finding and we will make the data available to your committee.

The data show that rainfall is acidic in many cases, and also that some sample lakes and ponds are acidifying and using up their buffering capability. Let me say that I find much data, and many studies on acid rain incomplete, and not fully understood.

I, personally, believe that a spirit of scientific inquiry requires that we challenge and question the more sweeping allegations heard about acid rain. We need to avoid ill-founded, hasty, or pseudoscientific conclusions. Basic research must continue on the issue of long-range transport and we ask your committee to assure that the U.S. Federal Government take a major role in that effort.

At the same time, however, right now, with the data we do have, trends we are seeing in Vermont are proper cause for concern. Our environment and natural resources are essential to the physical, spiritual, and economic well-being of this State. Sport fishing alone is estimated to generate over $50 million annually in Vermont.

We feel we have made great progress within Vermont to preserve and enhance these resources. Now, we are apprehensive about a threat which comes to us from outside our borders and over which we, as a State, have no control. One consequence of this is that Vermont's acceptable air quality is, to a degree, used up by others, with a resulting necessity of higher degrees of regulation needed for our own industries than would otherwise be the case, the so-called nonattainment status.

As I am sure you know, I an a strong advocate of the new federalism and strengthening of the appropriate role for the States.

In the spirit of federalism, States should be left alone insofar as possible to work out their own air quality implementation plans, so-called. Without downplaying that at all, however, we must recognize that air does not respect State borders, and so there must be national equity shown in the Clean Air Act itself or accompanying legislation monitored by the Federal Government.

No State or region should, for example, in the burning of coal or other fuel, gain economic advantage for its own citizens by avoidance of commonly accepted technology, resulting in degradation of the environment in other States, perhaps far distant.

We are, of course, not saying that the United States should forego coal as an important part of our energy supply. We must advance the use of properly designed and fired generating facilities. We are saying that where coal and other possible polluting fuels are used, they should be burned as cleanly as economically possible and with equalized cost-benefits, including the environmental costs, to all States and regions.

I believe that it is analogous, for example, to remind ourselves that, as a mountainous State, Vermont exports much of its water across the borders of our major rivers and lakes to other States and to Canada. The water we send across these borders is clean. Vermonters have taxed themselves heavily during the past 11 years to see that that is so, and we rightfully take pride in sharing with our neighbors in these watersheds, out of State, a healthy environmental commodity which we will send them.

Similarly, we receive, across our borders, air from other States and regions and we ask for like treatment.

Being a State with an international border, Vermont is very conscious of Canada and its reaction to the acid rain issue. I am struck by the fact that two successive Canadian national governments, of different political parties, each have deemed acid rain Canada's most serious environmental problem.

At the New England Governors-Eastern Canadian Premiers Annual Meeting, just held in St. John's, Newfoundland, acid rain was a topic of concern and we commissioned a full report on its effects on the region to be presented next summer.

I am pleased at the joint research Congress has encouraged and authorized between our own EPA and Canadian Federal scientists, and urge that it continue.

In summary, Mr. Chairman, Vermont urges a deeper understanding of this complex issue of long-range transport. The phenomenon is of national, perhaps even worldwide, scope, and indications now are it is affecting us here in our own State.

Even as we increase research and monitoring, however, we urge equitable solutions between States with equal fairness and sensitivity toward our neighbor, Canada. To achieve this, we look to continued and strengthened State air pollution control programs, but with a vigorous Federal Government assuring national and international equity.

Thank you very much.

Senator STAFFORD. Thank you very much, Mr. Whittaker. We will have you back a little later as Secretary of the Agency of Environmental Conservation from Vermont.

The first panel will consist virtually of Environmental Protection Agency people and other Federal officials.

I don't know whether Mrs. Gorsuch has decided to let people speak now or the officials concerned were able to persuade her that they needed a weekend in Vermont clean air. Whatever the reason, we are glad you are here. The panel consists of Mr. Dennis Tirpak, Director of the Office of Exploratory Research, Office of Research and Development, Environmental Protection Agency, Washington, D.C.; Mr. Lowell Smith, Director of Program Integration and Policy Staff, Office of Research and Development, EPA, Washington, D.C.; Mr. David Jones, Senior Group Director, Office of Environmental Reviews, Community and Economic Development Division, General Accounting Office, Washington, D.C.; Dr. Robert Friedman, Senior Analyst, Oceans and Environmental Programs, Office of Technology Assessment, Washington, D.C.

Gentlemen, if you will take positions at the witness tables, we would appreciate it. Anyway you would like to proceed is fine. It may be necessary to pass the microphone around from speaker to speaker.

I would suggest that you go in the order in which we introduced you starting with Mr. Tirpak, Mr. Smith, Mr. Jones, and Dr. Friedman if that is agreeable. Your full statements will be in the record and we would ask you to do your best to complete your statement in 10 minutes. Mr. Tirpak you are on. If I have mispronounced anybody's name, I apologize.

STATEMENTS OF DENNIS TIRPAK, DIRECTOR, OFFICE OF EXPLORATORY RESEARCH, OFFICE OF RESEARCH AND DEVELOPMENT, ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D.C.; LOWELL SMITH, DIRECTOR, PROGRAM INTEGRATION AND POLICY STAFF, OFFICE OF RESEARCH AND DEVELOPMENT, ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D.C.; DAVID JONES, SENIOR GROUP DIRECTOR, OFFICE OF ENVIRONMENTAL REVIEWS, COMMUNITY AND ECONOMIC DEVELOPMENT DIVISION, GENERAL ACCOUNTING OFFICE, WASHINGTON, D.C.; AND ROBERT FRIEDMAN, SENIOR ANALYST, OCEANS AND ENVIRONMENTAL PROGRAMS, OFFICE OF TECHNOLOGY ASSESSMENT, WASHINGTON, D.C.

Mr. TIRPAK. That is a very good pronunciation, Senator. Thank you very much for having us here this morning. I have brought Mr. Lowell Smith, who has been very active in looking at matters of interstate transport.

I will try very briefly to try to summarize my testimony and just ask that you submit it into the record. We will be talking primarily about effects of ozone, sulfates, and acid rain. I will try to discuss very briefly the interest of the Canadians and also discuss the research activities that we have underway in EPA, as well as in the Federal Government.

When we talk about ozone, we really mean that it is one of several oxygens that produce the interaction of organics through hydrocarbons and NO_X. Ozone, generally taken to mean aerosol, is an oxidation product of SO_2. Acid rain is really considered both a wet and dry deposition of acidic materials with sulfur or nitrogen origins. I would just like to put into perspective a little bit about what we know about the sources of some of these precursors.

It has been well discussed and identified that we emit approximately 30 million tons of SO_2 per year in this country. In recent years, it is down someplace around 29 million tons and trending down slightly since the midseventies. We had approximately 22 million tons of air wax. Almost all of these sources come from, all of this SO_2 comes from manmade sources.

Recently, there has been a substantial discussion about natural sources. I would just like to call your attention to the fact that only about 5 to 10 percent of the SO_2 in the northern part of the country comes from natural sources.

In fact, the electric power researchers' own estimates indicate that there is less than 2 percent of SO_2, which comes from soil sources. Mount St. Helen's volcano, for example, emitted, if you took the emissions that were coming out at its maximum, and averaged it for the entire year, it would amount to less than 1 percent of the SO_2 emitted from manmade sources.

As far as SO_2 is concerned, natural resources, at least in the Northeast, are fairly small—a small source.

Nitrogen, however, is a different story, and there are some substantial sources of nitrogen, from natural sources.

Mr. Smith will be talking about the transportation of these pollutants, the chemistry and deposition of these pollutants, so I will move along and talk very briefly about what we know about these pollutants.

First, ozone has been studied extensively and the impacts on crops, forests, and vegetation have been identified by many researchers. There are, perhaps, several hundred studies which are identified in our criteria document.

It deals with ozone and other photochemical oxidants. It is probably one pollutant which scientists agree that it does show toxic effects on crops, although I think there is a continuing disagreement as to the length and deliberation of exposure necessary for some of this injury.

I would like to call your attention to a particular table in that document which is table 11.4. It identifies a wide variety of crops which include beans, wheat, soy beans, radishes, and the various levels at which they are impacted by oxidants.

They are certainly impacted by oxidant levels which occur in the Eastern United States that is around 0.15 part per million.

Ozone has also been studied extensively in California, because of the high levels that have been present there, and the white pine, in particular, in that area of the country, has been shown to be susceptible. The changes that take place as a result of this really begin at the cellular level; move onto changes of photosynthesis; alter enzyme activities; finally get reduced plant growth and finally changes in the plant composition, where different trees are replacing others in a forest ecosystem.

In the area of health, Senator, there is continued alterations in mechanical lung function which constitute bona fide impairments of health in and of themselves. In the great majority of experimental studies in which oxidant exposures have produced changes in lung function. In healthy subjects, function has returned to normal within a few hours.

Thus, there is no reason to suspect that in healthy individuals, such changes promote any measurable increase in risk of future illness.

Nor is there any available evidence that shows in healthy individuals, a small change in ventilatory function unaccompanied by impairments of oxygen uptake will interfere with normal activity or performance. However, considerations suggest that oxidant-associated changes in lung function may signal impairment of health.

First, in persons with underlying respiratory illness, such as asthma, chronic bronchitis, emphysema, even small decrements in lung function often interfere with normal activity.

Second, at experimental ozone concentrations as low as 0.3 part per million, decrements in lung function have usually been accompanied by physical discomfort as manifested by sore throat, chest pains, cough, and headaches.

Thus, when associated with ozone exposure, changes in lung function can induce a level of discomfort that, even among healthy people, may temporarily restrict normal activity. For a complete discussion of these effects, I would again refer you to the criteria document that I have previously mentioned.

With regard to the effects of acid rain, Senator, we do suspect that there are substantial impacts on high elevation lakes; concern over materials impacts; on crops and forests and natural ecosystems, as well as our soil systems. By far, I think our best evidence really is the best we have is on our lake systems.

It was not far from here in the Adirondack Mountains in New York that acidification of a large number of U.S. lakes was first documented. As the previous speaker indicated, here in Vermont, the State has undertaken extensive surveys of its lake resources and has initiated long-term monitoring of a number of key lakes.

One thing to keep in mind, Senator, is that the process by which fish are impacted is really twofold: One, they undergo a pH shock and second, it has been demonstrated that at low pHs, we mobilize metals, particularly aluminum. So the toxic effects of acid rain are really twofold: One from pH shock and second from impacts of aluminum. These impact different life stages of the fish in different species in slightly different ways. Generally, when you get below a pH of approximately 5.5, fish begin to have trouble reproducing.

However, there is no question but that the impacts of acid rain do need additional research. We don't have, for example, in this country, a good long-term monitoring data base as is available in Scandinavia. We don't really know some of the complex mechanical interactions that take place in the atmosphere.

I think perhaps the question that I wish I could answer for you today is, how fast are our lakes going to deteriorate? If there is a question that I get asked all the time, that, I think, is probably one very question that all of us would like to know.

Unfortunately, we can't yet predict how rapidly that deterioration will take place.

Let me just speak for a moment about the interests of Canada. As you know, Canadians have, for some time, been concerned about air pollution and its effects, particularly the effects of long-range transport and acid deposition. The Canadians are both exporters and recipients of the emissions which contribute to long-range transport, and they have joined in a mutual effort to reduce their emissions.

On August 5 of last year, the United States and Canada signed a memo of intent between the two countries in which they both agreed to jointly study the transboundary air pollution problem. We, in fact, began formal negotiations which may lead to a treaty on June 23, this year, five working groups have been active in developing information and the purpose of these working groups, really, is to see if we can't agree, amongst the scientists in the United States and Canada, on what the basic facts are. If we can at least begin with a common understanding and a common set of data between the scientists, we would hope that then the policymakers of both countries could look at that data and begin to develop joint proposals for further control of acid rain, long-range transport.

I would note also, Senator, that our Administrator has met with high-level officials of the Canadian Government just as recently as this week and affirmed the U.S. intent of meeting with the Canadians so that we can understand their problems.

Other discussions are planned with other officials.

Senator STAFFORD. Could you summarize, now, Mr. Tirpak? We have you at 10 minutes.

Mr. TIRPAK. Certainly. Very briefly, sir, I will just say that we do have an extensive research program in EPA dealing with ozone. We are spending approximately $24 million on that problem ranging from air pollution modeling to effect studies, health studies. In the area of acid rain, we have a substantial interagency program which is running this year through fiscal year 1982; approximately $20 million.

There a wide number of agencies involved including the Departments of Energy, Agriculture, and Interior. I am convinced that as we begin to prepare our 1983 budget for this research, it will get every consideration in the administration in terms of the support needed to continue that program.

Senator STAFFORD. Thank you very much. We will go immediately to the next witness and reserve questions until all four have testified except for one thing: Mr. Tirpak, are you aware that when the so-called draft of possible proposals hit the press in Washington 2 or 3 weeks ago that it resulted in a rather extensive formal statement from the Canadian Embassy to our State Department?

Mr. TIRPAK. Yes, sir, I am.

Senator STAFFORD. Have you seen a copy of that?

Mr. TIRPAK. I have not seen a copy of it, sir.

Senator STAFFORD. I see. Do you know if there has been any reaction on the part of the Environmental Protection Agency to that statement?

Mr. TIRPAK. Mrs. Gorsuch met with the Canadian Ambassador this week. It is my understanding that we will be meeting with officials from the Canadian Government later this week, and future discussions are planned.

Senator STAFFORD. Thank you.

The next witness will be Mr. Lowell Smith. I have already designated his official responsibilities and title.

Mr. Smith, we are very glad you are here.

STATEMENT OF LOWELL SMITH

Mr. SMITH. Thank you, Mr. Chairman. My name is Lowell Smith. You have already introduced me. I will try to summarize briefly the written statement I have.

It takes no sophisticated analysis to recognize that pollutants can be carried in air masses across State boundaries to cause interstate air pollution. There are really three levels of the air pollution that we talk about, three levels of geographic scale: The local scale; the medium range, the mezzoscale; and a long-range scale.

Measured pollutant concentrations are the cumulative impact of these three scales of effects and we must deal with pollutants at all three ranges of transport in order to fully understand the concentrations and depositions that we measure.

Local and medium-scale situations can create interstate air quality management problems which I discuss briefly in my written statement but will not consider further in my oral comments.

It is well documented that emissions from a number of sources can accumulate in an air mass and travel long distances to cause interstate pollution. Such emissions may contribute to interstate air pollution in two ways: By increasing ambient air pollution condensations and by depositing pollutants out of the atmosphere. Thus we have learned that even though ambient concentrations of pollutants may be sufficiently low so as not to cause harm, the deposition of these pollutants back to the earth accumulated over some period of time can still cause significant damage.

I will describe briefly what is known about: (1) the principal emission sectors which contribute to interstate air pollution and their geographic distribution; (2) the meteorological processes contributing to interstate transport; (3) the chemical transformations which emissions undergo during transport; (4) monitoring results; (5) a qualitative description of the extent and frequency of interstate air pollution problems; and (6) the methods which are available for use in attempting to quantify the contributions that interstate air pollution makes to air and environmental quality problems in States downwind of major source areas.

Pollutants which may undergo long-range transport and contribute to regional pollution problems in multistate areas are ozone, sulfates, and nitrates. These are principally pollutants which are formed in the atmosphere from their precursors that are directly emitted fron anthropogenic sources and in some cases, natural sources. The precursor emissions for ozone, which are volatile organic compounds and nitrogen oxides, are introduced into the atmosphere, primarily from anthropogenic sources. On a nationwide basis from transportation-related sources are responsible for approximately 40 percent of the 30 million tons, annually, of manmade volatile organic compounds, while industrial processors and solvent users are responsible for another 50 percent.

The principal sources of ozone in the precursors are concentrated in the urban and industrialized areas through the United States. Principal anthropogenic sources of the 25 million tons of nitrogen oxides emitted are the transportation sector, 40 percent; the utility sector, 31 percent; and the industrial sector, 24 percent.

The sulfur dioxide emissions that are responsible for sulfate formation are in large part released by the combustion of fossil fuels in large industrial facilities. About 39 million tons of SO_2 are emitted naturally. Eighty percent of these are released in the eastern part of the country.

Emissions or sulfur compounds from natural sources may be important globally, but the extent to which they play a part of the emissions in the United States when viewed regionally is probably minimal. As was previously discussed, these precursors that form acidic materials are thought to be principally suflur dioxide and nitrogen oxide compounds.

Senator STAFFORD. For our guests, Mr. Smith, it might be just worth repeating the tonnage of sulfur dioxide that is emitted annually since many who are monitoring may not be aware of the dimensions of this sort of emission.

Mr. SMITH. Our current estimates are that 29 million tons are emitted annually, Mr. Chairman.

Senator STAFFORD. Twenth-nine million tons. Thank you.

Mr. SMITH. Another approximately 4.5 to 5 million tons are emitted in North America, north of our border.

Moving on to meteorological processes, early in our study of air pollution, we focused on the fate of pollutants within a few kilometers of major sources. A principal case in point is ozone, which historically was thought to originate and remain in the area of precursors. Ozone production generated through secondary reaction processes involving urban emissions is still a dominant factor in U.S. cities, but new evidence has shown that ozone and its precursors are not necessarily confined to an urban complex, but can be transported hundreds of kilometers over several days.

Therefore, it becomes necessary to understand and quantify the contributions of pollutants that have been transported long distances to an urban center so that equitable solutions for meeting the ozone air quality standard can be reached.

Although we cannot yet model ozone transport formation and transport in general, we can, through study of specific ozone episodes, come to a clear scientific understanding of some of these transport situations. Those are briefly discussed in my written submission.

I think in moving on to the sulfate area, and ozone as well, we need to recognize that different meteorological patterns do influence the amount and rate of the formation of these pollutants from their precursors and the amount of transport that takes place. I discuss one in particular in my testimony in which we have a stagnating air mass over a high-emission area that remains for several days while the air patterns continually build up concentrations.

Then as the front moves in toward this meteorological pattern, we get very directed wind patterns, frequently toward the East and Northeast which carry these emissions and their pollutants to the areas far distant from the area from which the emissions came.

There are many other complicating factors. I don't believe there is time to dwell on these in any depth.

Moving on to the atmospheric chemical reactions and the cleansing mechanisms, we must recognize that the formation of ozone is extremely complex. To generalize, NO_x reaction—nitrogen oxide compounds react with volatile organic compounds in a polluted atmosphere to form ozone through a cycle photochemical oxidation . Even though many details of this cycle are not well understood, significant progress has been made so that it is now possible to predict, quantitatively for an isolated urban area, the relationship between precursor concentrations and ozone production.

It is important to recognize that some of these reactions are reversible.

On the other hand, sulfates are formed from the oxidation of SO_2 whereas nitrates result from the oxidation of the emission of nitrogen oxides. For both sulfates and nitrates, the final reactions are nonreversible. That means once we have formed sulfates and nitrates, they must deposit out of the atmosphere. That is how the atmospheres get cleansed.

As we heard from Mr. Tirpak's testimony, the deposition onto these sensitive ecosystems can cause problems such as acid deposition associated with these processes.

There is much uncertainty that continues concerning the atmospheric chemistry of some of these substances and processes. This uncertainty is primarily related to the rates at which the secondary pollutants are formed. Also, to some degree, the full array of chemical precursors require further analysis.

This means that we cannot be certain about the precise distance from a source region that is required to complete a chemical reaction or the deposition of these chemicals from the atmosphere, but in general, we know that the end products are oxidants, particularly ozone and sulfates and nitrates.

Moving to monitoring results, we find that ozone monitoring in major U.S. cities has been a very active process over the last, at least, 5 to 8 years time. Considerable data has been collected and documented. These monitoring results are much less adequately documented in rural areas. Recent information gathered in intensive field experiments and regionally oriented networks have demonstrated the existence of multiday episodes of high ozone concentration that mainly occur during the summer and encompass significant portions of the United States.

During air stagnation episodes, sulfate concentrations may be continuous across many State boundaries. These polluted air masses have been traced as they move far over the Atlantic from the continental mass.

Occasionally, they have been traced through satellite studies, photographic studies. They have been observed to circle back over the continent, far from the region of their leaving the continent initially.

Monitoring for wet acidic deposition has greatly improved in quality and quantity over the past few years time. The quality of the data from more than 100 monitoring stations now operating is much superior to that of a few years ago.

Senator STAFFORD. Mr. Smith, could you summarize now? You have used 10 minutes.

Mr. SMITH. Thank you.

I will then simply note that much of the northern portion of the eastern half of the United States has acidic deposition and in significant quantities, principally from nitrates and sulfates associated with the hydrogen ion.

We have many individual storm events which has acid content substantially below the average concentrations of about 4.2 to 4.3.

There are many transport studies that have been done in the United States to substantiate the generalizations I have made in this testimony. I think of particular interest is that these studies have traced air masses from as far as the gulf coast and the Midwest to the Northeast, which have both high ozone and high sulfate concentrations; and that principal time of year that these are of most active is during the summer months; and these occur mainly during episodic situations.

Moving on to source receptor relationships, the important point here, I think, is that in order to quantify for regulatory purposes the amount of control that may be necessary in source areas to protect sensitive areas or other receptor areas requires some kind of model to link the emissions over these distances to the concentrations and depositions in these receptor areas.

Models are in either a state of development or exist in relatively crude form for each of these pollutants.

Those that are most advanced are for sulfates. Those have been applied in many situations by both the international work groups that were previously referenced and by—in the use of preparing information for environmental impact statements and the like.

Those are treated in my testimony. I think I would conclude by saying that these tools are useful in giving us a preliminary understanding of the nature and extent of interstate sulfare air pollution and sulfate deposition.

We expect these tools will continue to be improved over the next few years time.

Thank you, Mr. Chairman.

Senator **Stafford**. Thank you very much, Mr. Smith.

The next witness will be Mr. David Jones of the General Accounting Office in Washington. I would suggest, gentlemen, that you switch around since that mike seems to work, so that the witness who is testifying can use the mike.

At the end of this panel, we will try to get a better set of microphones for the rest of the afternoon; Mr. Jones, you are on.

STATEMENT OF DAVID JONES

Mr. **Jones**. Thank you, Mr. Chairman.

The Clean Air Act as amended in 1970 recognized that pollutants emitted in one State could adversely affect air quality in another State. In enacting 1977 amendments, the Congress determined that the 1970 amendments had not provided adequate protection against interstate transport of pollutants.

Accordingly, in 1977, the Congress provided the EPA with the authority to deal with this problem. They did this by revising section 110(a)(2)(e) of the act to require that EPA approve a State implementation plan only if—

> * * * it contains adequate provisions prohibiting any stationary source within the State from emitting any air pollutant in amounts which will, one, prevent attainment or maintenance by any other State of an ambient air quality standard, or, two, interfere with measures required to be included in the applicable implementation plan for any other State to prevent significant deterioration of air quality or to protect visibility.

Despite these provisions, however, Mr. Chairman, many States believe they are adversely affected by the interstate transport of pollutants. Several factors have hampered efforts to implement the Clean Air Act provisions for addressing the problems. These factors include: EPA's limited technical ability to accurately identify and assess the problem of interstate transport of pollutants, particularly in the science of air quality modeling; the broad language of the act which makes it difficult to deal with specific situations; and a lack of EPA regulations to clarify the language of the 1977 amendments.

In short, the interstate transport of harmful pollutants continues to be a major environmental problem and is the cause of numerous disputes between States, industries, and EPA as to what needs to be done to effectively resolve it.

Air quality modeling problems: To determine if a source of pollution is adversely affecting air quality in another State in violation of the prohibitions of the Act, EPA uses air quality modeling. Modeling capabilities are limited, however, and there are problems associated with their use. One basic problem is deciding which models to use. EPA has approved several models for use in different situations.

One model is recommended for use in modeling emissions from a single source where there are no major meteorological or terrain variables, whereas another EPA model is used to measure the short-term effects of multiple sources. Another modeling weakness is the need for assumptions where actual data is not available. Prohibited interstate transport is likely to occur during the worst combination of meteorlogical and operating conditions.

Actual data on these circumstances might not be available. Therefore assumptions have to be made about them.

The choice of the assumptions often leads to controversy. Perhaps the most serious deficiency of the models, however, is their lack of accuracy. An EPA modeling expert told us that at locations very close to the source being modeled, actual concentrations of a pollutant can vary 50 to 200 percent from those predicted by an EPA approved model. Models become less accurate as the distance between the source and the point of impact increases.

Moreover, at greater distances, the emissions from many sources can merge. Modeling the impact of an individual source from among these merged emissions is very inaccurate on a long range. For instance, EPA approved total suspended particulates and sulfur dioxide models have a range of only about 30 miles.

Improving a model's accuracy requires that it be validated. Validation involves gathering large volumes of data on weather conditions and pollution concentrations. The model's predicted values are then compares to the actual concentrations measured and the model is refined.

Because large amounts of data must be gathered, validation is very expensive.

In addition to the problems of range and multiple sources, unknowns about the conversion of sulfur dioxide to sulfates makes it difficult for models to quantify the long-range impacts of sulfur dioxide emissions.

An EPA modeling expert told us that models dealing with conversion need more refinement before they can be approved for regulatory purposes.

Most of the current interstate disputes involve complex issues which the broad language of the act does not specifically address. In some cases, resolutions of these disputes may force EPA to make controversial interpretations of the act.

In others, EPA has been able to avoid sensitive decisions because models cannot quantify an interstate impact. For instance, the act prohibits pollution transport that prevents attainment and maintenance of an ambient air quality standard in another State. But neither EPA nor the act's regulations explain whether an out-of-State source contributing to an air quality standard in another State is considered to be a violation if in-State sources also contribute to the violation.

The act also prohibits a source of pollution from interfering with another State's PSD measures, but the act does not elaborate on this prohibition.

For example, it does not specify the amount of a PSD increment that can be used up by an out-of-State source.

EPA has issued no regulations specifying how States are to comply with the act's requirements concerning interstate transport of pollutants.

Our review of EPA regional office and State files for nine Northern and Midwestern States disclosed that only one plan contained provisions specifically addressing the actions it planned to take so that sources in that State did not adversely affect other States.

Questions regarding the amount and circumstances of interstate pollution transport that violate the prohibitions of the act remain unanswered, and therefore have hindered the ineffectiveness of the act.

EPA officials told us that they have not issued regulations answering these questions because they involve complex issues which are difficult to address and because modeling limitations would hinder effective implementation of the regulations.

Senator STAFFORD. Mr. Jones, I don't know if this will help or hinder witnesses, but we might try it: You have used about 6 minutes of your time.

Mr. JONES. Yes, sir. One official told us that the EPA cannot resolve these issues entirely on its own and that congressional action is needed. Interstate transport remains a problem despite the stronger provisions of the 1977 amendments.

In some cases, State officials are concerned about a major source or sources just outside their borders. In others, they are concerned about pollution transported long distances.

Many complaints of interstate transport are aimed at sources in the Midwest. Several Midwestern States have higher sulfur dioxide emission limits than other States, to allow sources to burn locally available high-sulfur coal without controls or with minimal controls.

The Northern States are very concerned about high sulfur emissions in the Midwest. Air quality officials in the Northeastern States believe that sulfur dioxide converts to sulfates as it travels, increasing the ambient particulate levels and causing acid rain and sulfate deposits in their States.

Officials in other States such as Pennsylvania and West Virginia are concerned about what they perceive to be inequities in emission limits among neighboring States. Ohio has lower sulfur dioxide emission limits than Pennsylvania and West Virginia for this reason, Pennsylvania and West Virginia are under pressure from sources in their State to relax existing sulfur dioxide limits.

Since the 1977 amendments made it possible for States to petition EPA concerning the transport of pollutants from one State, six States have filed a total of eight petitions claiming they were being hurt by interstate transport of pollutants. All of these cases involved the alleged transport of sulfur dioxide or particulate emissions. In addition, at least three law suits have been filed against EPA regarding interstate transport.

Mr. Chairman, several policy issues arise when reviewing problems of how to effectively address interstate transport of pollutants. I would like to mention some of the ideas and approaches presented by various State officials and researchers to us during our work. Major policy issues which we believe need to be resolved include: How much interstate transport of a particular pollutant constitutes the prevention of attainment and maintenance of an air quality standard?

How much interstate transport constitutes interference with a State's PSD measures? Emission rates allowed by States involved in interstate transport disputes can be significantly different. Should such differences be considered in deciding whether interstate transport violates the Act?

Should interstate transport be allowed to consume a State's growth margin achieved by a State which has historically required controls stricter than required to achieve and maintain an air quality standard?

Even if we could answer some of these questions, there are modeling limitations that may preclude definitive answers to some of the questions. Several ways, however, have been suggested for handling these problems. Some of them may require changes in the act.

For example, should national emission standards be established? Such an approach would require all similar sources to meet some minimum sulfur dioxide emission limit, even if it is more stringent than necessary to attain the air quality standard in the immediate vicinity.

Sources located in areas with serious air quality problems would be required to meet stricter standards established by State agencies if they are needed to maintain the standard.

Should regional emission standards be established? Since most of the sulfur dioxide sources allegedly causing long-range and interstate impacts are located in the Midwest, regional sulfur dioxide emission standards may be more appropriate than national standards. Establishing regional boundaries, however, could be a problem, and States that have to impose emission reductions on their sources for the benefit of downwind States may feel they are being treated inequitably.

Should limits be established on State sulfur dioxide emissions? Under this approach, the State would determine which sources to subject to controls in order for the State's total pollution loadings to remain below established limits. No source would be permitted to emit at levels that would violate the air quality standard.

Finally, should emissions taxes be instituted? Such an approach would permit a source to emit pollutants into the atmosphere, but it would pay a tax to do so. At some point, it would be more economical for the operators to install control equipment.

However, if the tax is not set high enough, the result could be an increase in emissions and ambient standards violations rather than a decrease in emissions. Also, as with emission standards, sourced in isolated areas that were perceived as having no effect on public health and welfare would be taxed. Some may believe this to be inequitable.

Mr. Chairman, this concludes my statement—getting it done in 10 minutes.

Senator **Stafford**. We will remind our witnesses that their statements will appear in the record. We understand the reluctance at which somebody who has worked hard to prepare a detailed statement to depart from it in 10 minutes.

Mr. Friedman, you are a senior group director, senior analyst, oceans and environmental programs.

STATEMENT OF ROBERT FRIEDMAN

Mr. **Friedman**. Thank you, Mr. Chairman. I will be talking today about secondary pollutants, acid rain and ozone, which result from the chemical transformation of three primary pollutants, sulfur dioxide, nitrogen oxides and hydrocarbons.

These transported pollutants have been associated with, and in some cases have been identified as a cause of, damaging to natural resources, manmade materials, and human health.

Transported pollutants, as well, they impose significant inequities, as the impacts may be experienced by different groups, regions and even nations than those that receive the benefits of the activities that generate acid rain and ozone.

Moreover, different groups and regions may bear an unequal share of the costs of transported pollution control.

Long-range transport pollutants have become an issue for potential Federal action for two reasons: First, these pollutants do not respect political boundaries. They are transported across both State and national boundaries.

Second, Congress is presently considering the reauthorization of the Clean Air Act legislation which, in its present form, does not directly address long-range transport pollution.

Given the scope and complexity of the issue, I will divide my testimony into several parts. However, in the interest of brevity, I will not examine the question of what we know about transported pollutants from the time they were emitted until the time they are deposited, because Lowell Smith has already presented this information.

I will be moving to page 4 of my testimony. Let me just say that even though we do not know all the scientific details about transport and transformation of pollutants, we do know that some regions emit more pollutants than others and that some regions, not necessarily the same, receive more pollutants than others.

These regional differences give rise to a variety of policy issues.

Just to give you a better feel for the regional variations in emissions and deposition, I will use the sulfur component of acid deposition as an example. I have chosen sulfur products as my example because sulfate is often used to relate acid deposition to effects on lakes and streams.

To go to the first slide, major sources of manmade sulfur emissions in the United States are fossil-fired utilities, accounting for almost two-thirds of the total 30 million tons of sulfur dioxide emitted annually. As one can see from this map of emission density, the distribution is not uniform across the northern United States. Ohio, Indiana, and Pennsylvania contribute almost 25 percent of the total.

Now that we have seen where the sulfur goes up, let me show where it probably comes down. Next slide, please? This next map shows the sulfate deposit in rainfall during the spring and summer of 1979. These data show only part of the sulfur deposited during the year; after adding the rest of the year's rainfall and the amount deposited from dry fiel, the amount may be two or three times greater. I am sure those in the back can't read those numbers. Just to put them in perspective, the sulfate loadings, the amount deposited is greatest in the Northeast United States and Southeast Canada.

As well, a large portion of the Northeast exceeds the value that some scientists feel that serious acidification occurs in lakes and streams.

Let's now look at how the patterns of acidity relate to the distribution of sulfate. As this next map indicates, the areas of greatest acidity, or lowest pH, coincide with the areas of high sulfate deposition. The greatest deposition of both acidity and sulfate, again, follows a corridor through the Northeastern United States and Southeastern Canada.

To this point, the information I have presented is incomplete for determining areas that might be affected by—rather than just perceived—acid deposition. In addition, we need to know how sensitive the resources are. For lakes and streams, this means examining the characteristics of the surrounding watershed.

By analyzing the soils and geology, we can determine which areas have the ability to neutralize acidity, even though they may receive a large amount of atmospheric loadings.

This next map indicates areas where lakes and streams may be adversely affected by acid depositions. Within these marked areas, there are approximately 100,000 miles of lakes and streams and 20,000 lakes. We are in the process of now estimating what percentage of these lakes and streams are sensitive to current levels of acid deposition.

At this point, we are still left with the question of the sulfur deposited in a State originates are outside the State's boundaries.

My next map, based on some very preliminary modeling results and subject to the qualifications that both Mr. Smith and Mr. Jones pointed out, presents the percentage of sulfur deposited within regions of the United States and Canada that originated outside these regions. As you can see on this map, all regions in the Eastern United States and Canada received some sulfur deposition from outside the region, however, some areas receive a much higher share. New York, for example, appears to receive up to 70 percent of its total sulfur deposition from outside the region.

I would like to just state at this point, Mr. Chairman, that these are very preliminary results, and no doubt, within month, they will be changed somewhat. But they are the state of the art.

We are concerned about transported air pollutants because they have been associated with or identified as being a cause of damage to natural resources, man-made materials and human health. What do we know about the effects of acid rain and ozone? Let's quickly turn to this question.

The great burden of evidence points to adverse effects from acid deposition on lakes and streams and suggests that altered water chemistry will be the first response in sensitive aquatic systems. Time-trend data shows this alteration is now occurring in sensitive areas in New York, New Hampshire, New Jersey and North Carolina. Estimates of the cost of current impacts to lakes and streams range from about a $125 to $250 million annually for the Eastern United States.

For agriculture, we know that ozone may account for up to 75 percent of air pollution-related damage to crops—between $1.8 and

$3 billion annually. Damage to crops from acid rain under natural conditions has not yet been observed, although experiments using simulated acid rain have resulted in quantifiable alternations of crop quality and in yield reductions. Ozone damage within forests has been observed. But our knowledge of the concentrations of ozone necessary before damage occurs and which tree species are most sensitive is not very good.

Acid deposition may have both positive and negative effects for forests. Deposition can add essential nutrients, but also remove other essential nutrients or release metals that are toxic to plants.

We know that air pollution can damage a broad range of materials, building stones, steel and paint to name a few, but we have much to learn about which pollutants or mixes of pollutants are responsible.

The National Commission on Air Quality estimates annual costs of around $3 billion from air pollution damage to materials. Health effects from transported pollutants is a topic of great controversy. Airborne sulfate concentrations correlate with mortality, but whereas a causative agent or as an indication of other factors not considered is uncertain.

Toxic metals have been found in drinking water, possibly as a result of acid deposition which can leach metals from soil and plumbing, but no clear evidence of adverse health effects exist.

Estimating the costs of reducing pollution also presents difficulties. We can, with some accuracy, estimate the direct costs of installing pollution control equipment. We are less successful at estimating a host of indirect costs. Several contractor studies commissioned by both EPA and DOE estimate that by 1990, eastern utilities could reduce sulfur dioxide emissions by about 30 percent at direct costs ranging from slightly less than $1 billion to slightly more than $2.5 billion.

These costs would translate into increases in electricity rates of approximately 1 to 2 percent.

Given the uncertainties in scientific understanding and the gaps in our knowledge about costs and benefits, many have questioned whether this is the appropriate time to consider changes to the Clean Air Act that are responsive to transported air pollutants.

Phrased another way, the question is: What are the tradeoffs between congressional action during the upcoming reauthorization of the Clean Air Act, or waiting until a better scientific consensus is reached and the extent and implications of transported pollutants?

To put the question in perspective, this committee may wish to consider how long it might take to counteract the effects of a decision they later felt was wrong. Let me illustrate with this very speculative diagram. This diagram shows for each particular resource at risk, the length of time we think it takes for damage to occur, versus the amount of time we think it would take for recovery if pollutant loadings are reduced.

For example, crop damage from ozone occurs during a particular season. If we are able to eliminate the ozone next year, next year's crops would be normal. The damage is not cumulative from one year to another.

In contrast, lakes and streams may take a long time to acidify—on the order of decades. Each year's deposition may further remove *the natural capacity of the watershed to neutralize acid.* The effects may be cumulative.

Many scientists feel that the longer we wait to reduce acid loadings, the more lakes will have become sensitive to acid deposition, even if acid loadings are reduced in the future. The recovery of lakes and streams will depend largely on the recovery of the soils in the watershed and this might take decades.

This chart illustrates many other potential effects that might take a long time to consider. I would just briefly like to mention one other: If we adopt increased pollution controls, the costs will be borne by society for many years. Actions that we take today that we may later find to be incorrect or ineffective will waste money and resources and impose unnecessary costs on the industry and public.

Mr. Chairman, I would like to summarize the main points made in my complete testimony.

Point one, transported pollutants have become a political issue for several fundamental reasons: Public concern has increased about the potential resources damage that may be caused by acid deposition and ozone, as well as the direct and indirect costs of controlling transported pollutants are potentially substantial.

Different groups and regions may bear an unequal share of both the damages and the costs of pollution control.

Point two, transported pollutants have become an issue for potential Federal action for several reasons: These pollutants do not respect political boundaries. As well, the existing mechanisms for air pollution control are governed by the Clean Air Act, legislation which may not be adequate to address the problems posed by air pollutants.

Point three, although there is uncertainty about the scientific details, we know that certain air pollutants can be transformed into other pollutants, including acid rain and ozone, and transported long distances.

Point four, there are large regional differences in both pollution emissions and pollutant loadings. A large portion of the acid deposition and ozone within a region originates from outside the region with some areas receiving more than others.

Point five, there is compelling evidence that lakes and streams have acidified over the last few decades and acid deposition is the most likely candidate. Potential effects of acid deposition to forests, agriculture, materials, and human health are often concerned from limited experimental evidence, as well as theoretical considerations.

Point six, agricultural damage from ozone is well established. The extent of ozone damage to forests is less well understood.

Point seven, both the costs of these potential damages and the costs of controls have been estimated to be billions of dollars annually.

Finally, Mr. Chairman, waiting to control transported pollutants until our understanding improves may result in additional damages that may take decades to recover. Acting too soon to control these pollutants may result in large sums of money ineffectively spent.

Thank you, Mr. Chairman, for this opportunity to testify on our current study. In the next few months, we hope to have additional information and further analyses for this committee and the Congress.

Senator **Stafford**. Thank you very much, Dr. Friedman.

Since members of the committee are scattered throughout the country right now, but will be interested in your testimony, the Chair is going to reserve the right to members to submit questions to you in writing, if that is agreeable, gentlemen, for responses in writing after we are all back in the summer heat in Washington.

I trust you don't have to hurry back too soon.

Let me ask all of you if you have a short comment, or any one of you or all of you. Would it be possible to get interim reports from the 1980 studies which the Congress authorized and funded on air pollution, generally, and acid precipitation in general?

I know that is a 10-year study. It is my personal feeling that we ought to get early interim reports from that and not wait for 10 years to find out what the committee is reporting. Would you have any comment?

Mr. **Tirpak**. I certainly agree, Senator. We have, of course, built into the draft plan that has been sent to the Congress some milestones on which reports would be available. I think that there will be many studies coming out in the next 2 or 3 years that will certainly help to put the problem into a better perspective. We hope, for example, in the area of crops, to be able to say something, I think, within the next year; at least help us point to the direction to what the key issues are and help us to define our research better. I think, also, in the area of ground water, we will have a better handle on that and what we know about how streams have changed.

I expect that there will be reports coming out. We certainly aren't going to wait for 10 years to pass.

Senator **Stafford**. Thank you very much.

Do any of you have any estimate on what percentage of the total loadings of the atmosphere are transported interstate; for example, how much of the 29 million tons of SO_2 stays within the generating State? Dr. Friedman?

Mr. **Friedman**. Senator Stafford, the results I showed as, I believe, my figure 5, give ranges of sulfur—I mean, from outside a region that is deposited into a region, and these range from, as you can see, from 20 to 70 percent. I would like to say that, again, that these are very premature numbers, and rather than having this be looked at as avoiding the question, I would ask your patience for another month or two, when I think much better results will be available.

There are currently quite a few activities going on that are dealing with these transport models which are our best tools for estimating these percentages. They should be available quite soon.

Senator **Stafford**. Thank you. We would look forward at the end of another month or two for further information from you, if you will come ahead and volunteer it to our committee without our requesting it further.

Mr. **Friedman**. Most certainly.

Senator **Stafford**. Thank you.

Have any of you had the opportunity to review the report prepared by the Morgantown Coal Research Center? As the chairman understands this report, it suggests that acid rain is caused by the combustion of home heating oil which leads to the experience of a rather novel suggestion. Have any of you had access to that report? Do you have any comment?

Mr. **Smith**. EPA does not have any official position on this report. Unfortunately, DOE did not request EPA's review of it. To my knowledge, it has not been subjected to peer review within the scientific community. The response I am giving you now is my personal response based on my review of that report.

My own reaction is that it is seriously flawed in several respects; although it purportedly described what the local source impacts are on acid deposition, it failed to define what it meant by local or a local source or by local transport.

Therefore, it is very difficult to come to any conclusion as to what its bottom-line analysis shows for local impacts because it doesn't tell you what I mean about local. It used a model which is an atmospheric transport model, which is not suitable to the kind of analysis that it attempted to carry out.

In fact, that model has been severely criticized by others in industry when used in other situations.

It apparently ignored long-range transport source receptor relationship studies which have been done by quite competent scientists in the area. It is embarrassingly silent of those results from competent researchers.

My own impression is that it is seriously flawed by a rush to judgment in drawing conclusions from the sparse data and poor quality analysis presented in the report.

In summary, I think it is a misleading report which is best ignored. For your information, another preliminary investigation of the role of primarily emitted sulfates on deposition of sulfates has been conducted. It comes to quite different conclusions than what are contained in this report.

Senator **Stafford**. Thank you very much.

Dr. Friedman, one last question: As I look at your figure No. 4, it appears that all of New England is sensitive to acid rain with the exception of the northern parts of Vermont. If I look at the chart correctly, I think that where we are sitting today, Randolph, is probably in the sensitized area.

Then I look at your figure 5, and I appreciate that you have indicated this is but a preliminary figure at this point, but if I understand it, on the data you have now, subject to change a bit later if necessary, 55 percent of the deposited sulfur products hitting Vermont comes from outside the State.

Do I understand that correctly?

Mr. **Friedman**. Yes. That is right, Mr. Chairman.

Again, this is a preliminary. I would like to also make one comment on figure 4. These are areas that—the caption underneath the figure is not quite as complete as it might be. These are areas that may have done damage to aquatic ecosystems.

Just to clarify, the northern part of Vermont has very extensive soils, potentially sensitive to nutrient effects which may eventually affect forests.

Senator **Stafford**. Thank you very much. Thank you all, gentlemen. We are very grateful to you for coming all the way up here and helping this committee. It is a very difficult task to rework the Clean Air Act. We are very grateful.

Now we will take about a 2-minute break while we try to get the microphones in better position.

[Brief recess.]

Senator **Stafford**. The committee will please come to order.

The next panel will consist of Dr. Richard Klein, professor of botany, University of Vermont; Dr. Alan Cassell, director of Water Resources Research Center at the University of Vermont; Dr. David R. Hemenway, assistant professor of civil engineering, University of Vermont.

Gentlemen, you may either proceed in the order in which you are listed or in whatever order you prefer. I will leave that to you to decide. We are happy you are here. I would ask you to stay within 10 minutes. Your complete statements will appear in the record.

STATEMENTS OF RICHARD M. KLEIN, PROFESSOR OF BOTANY; ALAN CASSELL, DIRECTOR, WATER RESOURCES RESEARCH CENTER; AND DAVID R. HEMENWAY, ASSISTANT PROFESSOR OF CIVIL ENGINEERING, ALL OF THE UNIVERSITY OF VERMONT, BURLINGTON, VT.

Mr. **Klein**. Senator Stafford, my name is Richard Klein. Together with Prof. H. W. Vogelmann, a professor and ecologist in the botany department of the University of Vermont, we have for several years had a major research project on acid rain.

The first question we asked is whether the precipitation in Vermont is significantly acidic. The answer, which has been based on extensive monitoring of precipitation on Camels Hump and Madonna Mountains and at Botany's Proctor Maple Research Farm in Underhill, is yes. In general, the acidity of the rain is approximately that that has been recorded for other areas of New England, ranging between 50 and 100 times more acidic than is pure rain water.

The fog that condenses on leaves and needles is an important water source for Vermont's mountains and watersheds and this, too, is acidic with pH values at about the same level as that of the rain.

While these values are approximately that of rain, the fog water, particularly at higher elevations, is much more copious than that of rain, so that the total acid load reaching the forest of spruce and fir is much greater than that reaching lower elevations. Snow, and the rime ice are also acidic, and the acidities that we have found, again, are not atypical of those reported elsewhere in New England.

The chemical composition of the acids in the precipitation has been determined. They are primarily sulfuric and nitric acids, and in general, there is about twice as much sulfuric as nitric acid. At upper levels of the mountains, the fog tends to be somewhat enriched in nitric acid. These ratios are, again, nontypical of those reported elsewhere in New England and in the Adirondack Mountains of New York.

The acid components that we have been measuring are those that are dissolved in precipitation. There are, based on studies done in a number of laboratories, significant inputs of acidic substances in what is called dry fallouts that eventually are washed off foliage into the soils.

There are some other chemicals that will—in precipitation—that must enter into our evaluations. We have found that several heavy metals are present in rain and fog and have data showing that copper, lead, and zinc are present in measurable quantities.

Monitoring activities have also been conducted on the plants of Vermont mountains. In the 1960's, a complete ecological study of Camels Hump Mountain was made as a Ph. D. thesis in botany.

Two things are important about this study: First, it was done with no thought of acid rain research. In addition, one of the many examples of the potential importance of basic scientific research which sometimes, years later, proves to be invaluable. In this instance, because of this research, the botany department has a data base unmatched in North America that allows us to make comparative evaluations of changes over a significant period of time.

Equally important, the conifer zone of Camels Hump is a projected ecological zone, unique for its ecology, elevation and aspect, and in the fact that it has not and must not be used for other than research.

Economic exploitation, not only of the upper elevations, but also of the lower elevations, which are not yet protected, will destroy for all times an irreplaceable research tool for acid rain and many other ecological investigations.

The ecological survey done in the 1960's was completely and precisely repeated in 1979, the data sets computerized and each plant species at each elevation compared for possible changes that have occurred in the intervening period.

We paid particular attention to the tree species, since they are a basic aesthetic, ecological, and environmental importance, not only for the mountains, but also for the entire watershed of the State.

On most New England mountains, there is a well-marked zonation on our mountains in terms of plants. Below about 2,400 feet, the forests are primarily hardwoods, maple, and beech, et cetera.

Between 2,400 and about 2,600 feet, the forests are in transition from the hardwoods to softwood conifers and above about 2,800 feet, the forests are dominated by red spruce and balsam fir. This latter is the boreal forest that extends both north and south of Vermont.

Three ecological measurements are used to evaluate dynamics of trees. The first is density; that is how many trees are there per unit area.

The second one is basal area; that is, how much of any given area is covered by each tree species?

The third measure is the range of stem diameters from which various size classes of trees can be determined. We have used all of these measurements. I would like to present percentage changes that have occurred between the 1965 original study and our restudy in 1979.

The most striking change i:n tree species was found in red spruce. In the boreal forest, the upper elevation zone on Camels Hump, the density of small, medium, and large-sized spruces decreased markedly, with the greatest decrease approximately 50 percent, found among the larger trees, those of 10 centimeters or greater diameter.

This decrease in stand density was paralleled by decreases in the basal areas covered by red spruce.

Red spruce is not the only species showing changes. Balsam fir is increasing with the youngest trees showing the great increase, as is true of white birch, also found in the boreal zone. It is possible that as the spruce dies, the competition for soil, water, light, nutrients, and space becomes altered and that these other trees are taking over the cites that were formerly occupied by the spruce.

Thus, while our forests in Vermont remain, their composition, which is reflected in many ecological interactions, will be vastly different.

May I have the next slide, please?

Comparative studies have been made on Mount Abraham, Bolton Mountain, and Jay Peak, and they have given the same results. Our observations in the Adirondacks and other upper areas of New England and as far south as New Jersey, parallel our findings in Vermont. Red spruce decline is real.

Spruce decline and dieback is also occurring in Germany, Canada, and possibly other areas of the world.

May I have the first slide back, please? In the hardwood zone on Camels Hunp, the lower elevations, both sugar maple and beech are decreasing in density and in basal areas, and the yellow birch is decreasing in density, but not in basal area.

Although the percentage changes in these hardwoods is not as dramatic as it is for spruce, they demonstrate very real alterations that may eventually result in ecological changes in forest composition.

Knowing that there are important alterations in the forest composition in Vermont's and other mountains, leads us to the development of research on the reasons for these changes. I must reemphasize that only because we had this data base for Camel's Hump could we focus our experimental designs on causal factors, and it also allows us to conduct laboratory simulation experiments and then evaluate the results of these experiments directly in the real world, again, on Camels Hump Mountain.

Our findings, substantiated by reports from other laboratories, that there is significant quantities of heavy metals in precipitation, suggested that we should analyze for these metals in the soils in Camels Hump.

May I have the third overhead, please? On the average, the lead concentration in the soils increased by almost 90 percent. Zinc by 70 percent, and copper by 40 percent between 1965 and 1980.

Aluminum, which is normally present in the mountain soils, but in insoluble and nonavailable and nonmobile forms, appears likely to have become much more soluble.

We are actively studying, at both the laboratory and the field level, whether these concentrations of heavy metals now in our soils play a causal role in the alterations we have found in plant development.

In the 1965–80 period, there has been a marked increase in the amount of organic matter in our soils. Put very simply, the leaves and the needles that fall from trees are not breaking down into humus as rapidly as they did prior to the period of our study. This means that the recycling of nutrients, nitrogen, phosphorous, calciun, potassium, back into living plants may be reduced. This is now under study by our research group where we are measuring the leaching of spruce needles by acidic precipitation, the activity of microorganisms that decompose them, and the decomposition of the cellulose that makes up the humus.

We now know that the combination of acidity and heavy metals does depress this decomposition processes of leave and needle litter.

We have also found that the acidity of laboratory-made fogs increases the leaching of nutrients, sugars, and even proteins from living spruce and birch trees.

Whether this foliar leaching significantly deprives trees of necessary chemicals is, of course, under serious study in our laboratory.

Again, at the laboratory simulation level, we know that the combination of acidity and heavy metals interferes with the development of a variety of soil microorganisms including those nitrogen-fixing bacteria and blue-green algae that fix nitrogen of the air, the fungi that form nutrient-gathering associations with the roots of trees and mosses.

We and other laboratories here and abroad have investigated the obvious question of whether the alterations in forest composition resulting from and perhaps related to spruce decline might be due to insect infestations or tree diseases. We can say, quite categorically, that it is not.

The major question, indeed, the primary objective of our research is whether there is a cause and effect relationship between the fact that precipitation is acidic and contains heavy metals and the fact that there are quantitatively measurable alterations in the growth, productivity, and viability of plants, including trees, growing in mountainous areas of Vermont and other locations in New England, Canada, and Europe.

As professional scientists, we are unable at the present stages of research, to make this correlation. No research group in the world can answer this question at this time. It must also be strongly emphasized that our inability to state that there is a correlation between acidic precipitation and alterations in terrestrial ecosystems does not mean that acid rain and accompanying pollutions with heavy metals and other materials in rain and fog and snow and ice are not causal factors in the ecological changes which we are observing.

We are, however, confident that the multifaceted approach involving integrated laboratory and field research now in progress in the botany department at the University of Vermont and elsewhere is the only way that this important question can be answered.

Thank you very much.

Senator STAFFORD. Thank you very much, Doctor. We appreciate that testimony. Who will be next?

STATEMENT OF ALAN CASSELL

Mr. CASSELL. Thank you, Senator. My name is Alan Cassell. I am here fulfilling my role as director of the Water Resources Research Center. As you are aware, this is a cooperative State/Federal funded activity at UVM, which has as its mission to encourage and carry out research on water resource problems that have high priority to the State of Vermont.

First, I would like to briefly describe a recently completed effort to identify major water resource-related issues through solutions on well-focused research activities. Acid precipitation emerged as one of the concerns in greatest need of research.

Second, I plan to summarize work recently completed by Professor Donnelly of the University of Vermont. His research, "Assessment of Sites in Vermont for Their Susceptibility to Acid Rain," takes us about as far as is now possible without further research in making assessments regarding impacts of acid precipitation. I am summarizing this work at Professor Donnelly's request.

In 1979, Congress instructed the State water resources research centers to carry out a national assessment to establish a basis for focusing Federal investments in water research on topics of highest need and priority.

This assessment was conducted first on a State-by-State basis with the results combined into regional reports and finally a national assessment report to be prepared by the funding agency in Washington. In order to establish research priorities for Vermont, water and natural resource managers from local, State, and Federal agencies, as well as recognized researchers, were canvassed.

They were asked to identify, first, what were the most important water resource management problems and second, which of those problems could research help best to solve? These individuals were asked to rate the 11 most highly recognized water resource management problems as either being critical, important, or of low priority. The top three rated water resource management problems in Vermont were found to be ground water management; toxic and hazardous waste management, and waste water treatment, a topic the Senate is quite familiar with.

Acid precipitation was ranked 10th in a list of 11. When these same individuals were asked another question, this time they were asked which of these 11 management problems could best be involved through a more vigorous pursuit of existing policy or implementation of new policy or through research, acid precip and ground water were mentioned as the top two management problems requiring focused research.

Not surprisingly, research is most severely needed in areas like acid precipitation and ground water, where there has been little done in the past, and where the potential damage from the neglect of the problem could be extreme. However, it is not enough to say that research is needed to help solve problems associated with acid precipitation.

It becomes necessary to specify more exactly what research is required. Specifically, the following research was clearly identified as being required:

First, to determine what impacts acid precip has on Vermont's terrestrial and aquatic ecosystems. Research concerns must extend beyond those of sulfate, nitrate, and pH to include phosphorus and heavy metals.

Furthermore, an entirely different sort of research effort was also identified including an evaluation of the economic, social, and health implications of long-term continuation of acid precip over Vermont and New England; second, to explore alternative legislative and other institutional mechanisms for controlling this problem at its source.

I might say acid precipitation was also identified as a high-priority research need for the New England region generally. Specifically, the regional study stated that research is needed on the effects that chemical changes of surface waters, ground waters, and soils have on terrestrial and aquatic life, particularly on cold water and anadromous fish, on micro-organisms and insects in the terrestrial and aquatic systems, on soil processes, including decomposition and nitrogen fixation, and on vegetative growth in general.

At this point, I would like to change gears a bit and go back and talk a bit about Professor Donnelly's recent work. The purpose of his work was to identify criteria by which various agricultural forests and aquatic ecosystems in Vermont could be rated in terms of their susceptibility to acid precipitation.

An accurate representation of ecosystem susceptibility to acid precipitation was recognized that it must include a number of variables. Donnelly developed integrated susceptibility maps for both aquatic and terrestrial ecosystems in Franklin and Bennington Counties, based on the combined effects of geology, soils, land use, and precipitation: To do this, he first gridded Franklin and Bennington County maps into square-mile sections.

Then he recorded the geology, soils, precipitation, and land use characteristics of each section. Individual susceptibility values were assigned to these soils, to the bedrock, to the land use in each gridded section on the basis of literature-derived information.

An estimate of the integrated susceptibility was then obtained for each gridded section by summing the individual values. Based on these criteria, maps of integrated susceptibility were prepared. No high-susceptibility terrestrial areas were found in Franklin County, while high-susceptibility areas in Bennington County were restricted to those areas in the upper elevations of the Green Mountains.

On the other hand, the distribution of aquatic ecosystems' susceptibility was similar to the distribution of pH classes in selected lakes within the two counties that were recorded by the Vermont Department of Water Resources.

This similarity appears to support the general viability of Donnelly's procedure for assigning aquatic ecosystem susceptibility. In addition, Donnelly offered a number of conclusions. I repeat just two of them here to save time:

Donnelly states that the relative sensitivity of native plant species to acid precipitation is largely unknown. In fact, there is no direct evidence that acid precipitation has altered the species' composition and/or growth rate of any terrestrial ecosystem in Vermont.

Second—this is out of a fairly lengthy list—he states, if subsequent studies conclusively demonstrate that acid precipitation is significantly altering physiological responses in Vermont's terrestrial ecosystems, the problem may not be due solely to acids; rather, the problem may be due to the synergistic effects of heavy metals in combination with low pH.

In conclusion, it is clear to me that insufficient knowledge exists for society to judge the future consequences of acid precipitation on New England or on other parts of our country. We do not know the consequences if, as a country, we choose to do nothing for the next 10 or so years, nor do we know the consequences to, in some fashion, control acid precipitation.

We do not know the costs nor benefits or our actions or of inaction, either in terms of a regional or national economy; in terms of the long-range, long-term health of our peoples, or of the long-term impact on our aquatic and terrestrial ecosystems.

My testimony supports the notion that we have taken but a first step in the long road to address the acid precipitation/atmospheric and deposition issue. We now know some of the questions that we should ask. But we have precious nuances. We are even further away from rationally integrating the understanding of this issue into management and regulatory frameworks. Substantial research is needed. It should begin now so that we will have answers some 3 to 5 years down the road.

Thank you very much, Senator Stafford.

Senator STAFFORD. Thank you very much, Dr. Cassell.

Dr. Hemenway?

STATEMENT OF DAVID R. HEMENWAY

Mr. HEMENWAY. At one time, acid precipitation was thought to be a problem that occurred only in the European countries and the United States and Canada would not experience similar problems. However, current research and environmental measurements clearly show that the United States is experiencing its own acid precipitation.

Most persons accept the traditional source transport receptor model, and as a result, if you question the concept of air pollution emissions being carried aloft and subsequently being deposited on the soil and receiving bodies of water.

Research carried out in the Department of Civil Engineering and Environmental Quality Laboratory has shown that the pH has reached values as low as 3.35 and the sulfate values have been as high as 9.8 million grams per liter in rainwater collected in the northern section of Vermont.

The pH was not the level one would have predicted for clean air in contact with carbon dioxide. A good correlation of 0.9 was found between pH and total soluble sulfate in the rain samples. Other laboratories have shown similar data and the documentation process has begun for documenting the trend of increasing acid precipitation.

Thus, if any statement it to be made about acid precipitation, it might be a brief one in that Vernont is experiencing effects from transport of acid-forming airborne contaminants.

Unfortunately, there are many questions that remain unanswered.

Acid precipitation or more correctly, suppression of precipitation pH by airborne contaminants, is poorly understood. The following are a list of a very few areas where we have insufficient information, and yet the questions apply directly to the problems created by acid precipitation:

What are the true environmental, social, and economic costs of acid precipitation? If you published studies to provide quantitative data on the costs of the effects of acid precipitation.

What is the relationship between the sources of air contaminants and the effects felt in the State of Vermont? The transport processes with subsequent rainout during transport and the photochemistry involved are poorly understood, thus making the relationship of source to receptor difficult to interpret. We do not understand at this point the stratospheric input into the transport models.

What are the potential long-range health effects from dry precipitation transport? So far, we have been focusing on wet precipitation, but there is also a dry precipitation component in the transport process.

What other effects would be expected to coexist with acid precipitation? It may well be that pH suppression is only the tip of the iceberg with respect to acid precipitation.

Studies are being conducted in our Department on the transport of selected heavy metals and their subsequent solubility in the presence of acid precipitation are forthcoming. These results will be gladly turned over to you. Other investigators have shown the effects of toxicity of aluminum ions on fish in depressed pH situations.

It is quite conceivable that many other toxic compounds would be both transported into the environment as well as released under the low pH conditions present in acid precipitation.

What is the recovery time of the environment, should the acid precipitation cease or if it were to be doubled? Obviously, the consequences of this is dependent upon what decisions we make with regard to the control of acid precipitation.

The questions of whether or not control technology exists often arises. For the most part, the technologies, both in equipment and management, exists. The control technology, however, is extremely expensive. Because of the interstate and international relationships of the air movement process, control efforts must be directed on a nationwide, as well as a continentwide basis.

Investigative efforts currently promoted by EPA and DOE center on receptor-oriented research and on source-oriented research.

This is based upon the funding levels of the two agencies involved. We need extensive research in the transport processes.

The answers to the questions that I have mentioned, as few as they are, are not available without further research, and obviously this will require funding. Control efforts will not be implemented until directives are issued from a central authority and these directives require enabling legislation.

No recovery of economic losses from acid precipitation will occur until the bills or laws exist to allow for this recovery.

Thank you.

Senator STAFFORD. Thank you very much, Dr. Hemenway.

The committee appreciates the assistance of all three of you in helping us with our assignment this year in the Committee on Environment and Public Works. On a little lighter note, I want the record to show that you were all as cordially received here as if you had been menbers of the faculty of Middlebury College.

One there that was woven through your presentations, it seems to me, was that we still need answers to the problems which may be created by acid rain.

In an earlier panel, we mentioned the 1980 authorized 10-year study of acid rain. I think the panel has agreed that it would be possible to get interim reports much earlier than that, some next year, that might help us along the way. All that is a preliminary to asking you, in your judgment, if you can make one, how long have we got to wait before we will either prove or disprove that acid rain is causing considerable difficulty in things like the forests on Camels Hump and agriculture crops throughout the country where acid rain hits and so on?

Do you have any estinates at all off the cuff that would help us on that?

Mr. KLEIN. Senator, Congress is well-known for going out on limbs, and I guess we can, as well. My estimate, conservatively, is about 3 to 4 years before we have anything that will be useful in the political process that will be unequivocal.

Senator STAFFORD. Thank you very much. Is there any disagreement on the panel with that?

Mr. HEMENWAY. No. I would say in view of the heterogeneity of the monitoring systems presently being applied to the problem that at least 3 to 4 years would be needed.

Senator STAFFORD. In Scandinavia and in Canada, they seem to have reached conclusions now that acid rain is doing substantial damage. Would you have any comment as to whether or not you think they have an adequate scientific basis in those areas for their opinions?

Mr. KLEIN. Not only in Europe, including Scandinavia, but also in Canada, as well as within the United States, the evidence relating to the role of acidic precipitation and the associated heavy metals regarding aquatic ecosystems is very well based. It is generally accepted in the scientific community.

The question is, speaking as a biologist, relating to terrestrial ecosystems, to agricultural lands taken broad is, I fear, not at the level of assurance that exists for the other part.

Senator STAFFORD. Thank you very much, Doctor.

Much attention these days focuses on acid rain, despite the many uncertainties which we have just been discussing. The committee also has some concern with the other pollutants that may be in the atmosphere. Perhaps you could tell us what information you might have with the following: Are sulfates transported into this State reducing visibility significantly?

Mr. HEMENWAY. The studies that are currently being conducted on sulfate are predominantly ones of human health. The studies that are available for visibility research due to the lack of a real-time sulfate analyzer are severely limited at this time.

Senator **Stafford**. Is ozone being transported into the State, and if so, do you have an opinion fron whence it comes and what are its effects?

Mr. **Hemenway**. I do not believe that there is sufficient documentation at this point to make a definitive statement about ozone transport. The evidence suggests that there is, however.

Senator **Stafford**. I noticed Dr. Klein was indicating a similar opinion, I think, by shaking his head negatively.

Are heavy metals being transported into the State, and what are their sources? Is there any indication they are being taken up by food crops or animals?

Mr. **Klein**. We have documented, as I spoke today, that heavy metals, in terms of lead, zinc, copper, and probably others as well, are being transported down onto Vermont land from the heavens above.

Whether this is long distance transported or not, our studies do not allow us to determine. As far as the question of their uptake by plants and by animals, this is very much of an open question. It is one of the areas that is currently under study in our laboratory, as well as in other laboratories throughout the world, and it is still open.

Senator **Stafford**. Thank you very much, sir. One final question: What is the funding source, may I question before the committee, of the research that you gentlemen have been developing?

Mr. **Klein**. I can be rather precise. Our funds come from three primary sources: One is the Vermont Agriculture Experiment Station, which, as you know, is the U.S. Department of Agriculture funding; second, it has been the U.S. Forest Service, which, again, is USDA; a third source is the American Electric Power Service Corporation.

Senator **Stafford**. Thank you very much.

Dr. Cassell?

Mr. **Cassell**. The funding for the work we do at the Water Resources Center is through the Department of Interior, the Office of Water Research and Technology. Just to make a funny here, I think we are slated to go out of existence the 1st of October, if I am not mistaken. The University of Vermont shares this activity, $1 for every $2 Federal money, so it is State money.

Mr. **Hemenway**. The funding in the Department of Civil Engineering is solely supported by the Department of Civil Engineering, so it is predominately all funded from the university.

Senator **Stafford**. Thank you all very much. From the Senate Committee on Environment and Public Works in the Senate, I believe we were able to continue the life of the water research programs and the river basic commisions; it is a somewhat reduced figure. We still have to examine the legislation of last Thursday and Friday to see what happened there, but I think there is reasonable chance those programs may continue.

We believe in them in our committee.

Mr. **Cassell**. That is good news.

Senator **Stafford**. That is a bipartisan observation.

I thank this panel on behalf of the committee very much.

Now we will go to the next panel which consists of law enforcement officers.

[Brief recess.]

Senator **Stafford**. We will ask the committee to kindly come to order.

This is a panel consisting of assistant attorneys general, deputy attorneys general, and assistant attorneys general from the Eastern part of the country. They have a special warm place in this Senator's heart, because I was the attorney general for this State back in my second career some 25 years ago, so I am particularly happy to have the opportunity to initially recognize Vermont's current attorney general, John Easton, who will speak for himself and the National Association of Attorneys General. John?

STATEMENTS OF JOHN J. EASTON, JR., ATTORNEY GENERAL OF VERMONT, NATIONAL ASSOCIATION OF ATTORNEYS GENERAL; KENNETH TEDFORD, ASSISTANT ATTORNEY GENERAL, HARTFORD, CONN.; LEONARD BRUCKMAN, DIRECTOR, AIR COMPLIANCE UNIT, STATE OF CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION; RICHARD HLUCHAN, DEPUTY ATTORNEY GENERAL, TRENTON, N.J.; MARY LYNDON, ASSISTANT ATTORNEY GENERAL, STATE OF NEW YORK; DOUGLAS BLAZEY, CHIEF COUNSEL, DEPARTMENT OF ENVIRONMENTAL RESOURCES, OFFICE OF THE ATTORNEY GENERAL, HARRISBURG, PA.; SUSAN BRAND, ASSISTANT ATTORNEY GENERAL, BOSTON, MASS.; and RON SHIPLEY, ASSISTANT ATTORNEY GENERAL, CHARLESTON, W. VA.

Mr. **Easton**. Mr. Chairman, I am delighted to be here and delighted that you would think enough of your home State to allow us the opportunity to testify right here in our lovely State.

I am surrounded by a group of real experts in this area, so I will just give a brief overview and submit for the record my comments. Rather than read them into the record, I will simply submit them and give you a brief overview that I appear both as the attorney general, and as the chairman of a newly created subcommittee of the National Association of Attorneys General.

I am pleased to be able to be here to relate to you and your committee that at its 75th annual meeting at the National Association of Attorneys General just last week adopted a resolution which I will be submitting which in its salient points, that supports the reauthorization of the Clean Air Act and urges Congress to, A, provide an active role for EPA in the enforcement under the act; B, to establish deadlines for attaining ambient air quality standards.

While recognizing that current deadlines may be impossible to meet in some areas, the association believes that the Congress, where necessary, should extend rather than eliminate these deadlines; C, we urge the Congress to develop all standards with public health and safety as the highest priority; D, we would urge the Congress to designate certain regions in cooperation with the States and State legislatures as PSD areas.

The prevention of additional pollution in certain areas is to be clearly in the public interest; E, we would ask the Congress to provide enforcement remedies available to both the Federal and State governments for instances of noncompliance with air quality standards. Reliance on voluntary standards without the availability of sanctions would undercut the purposes of the act.

Finally, we would urge the Congress to address the problem of interstate pollutants and acid rain. With that resolution passed just last Friday, June 26, by the national association, the association also created a subcommittee which I will be chairing. It will be made up of a broad cross-section of attorneys general based on not only political beliefs but regional interests and State concerns. Our hope for a timetable would be to deliver a report to your committee similar to the report last year that was delivered by New Jersey Attorney General Degnan on the toxic waste superfund bill.

My colleagues at the table will address some of their particular concerns. Later in the panel program, our secretary of the agency of environmental conservation will give far more detail on Vermont's problem as he sees it. As you know from your position as attorney general of this State in the past, the attorney general is the one who will enforce the State aspect of clean air enforcement and it is for this reason that I am very happy that your committee and you are holding these hearings.

With that, I will turn it over to the assistant attorneys general who are here from their various States.

Senator **Stafford**. Thank you very much, Attorney General John Easton, for being here. We welcome the work of your new subcommittee. The list of panelists that the Chair has been given seems to be larger than the number who are here. I should call the roll. Is Mr. Kenneth Tedford of Connecticut here?

Mr. **Tedford**. I am here, sir.

Senator **Stafford**. Mr. Richard Hluchan of Trenton, N.J.?

Mr. **Hluchan**. Yes, Mr. Chairman.

Senator **Stafford**. Did I get your name right?

Mr. **Hluchan**. Right.

Senator **Stafford**. Mary Lyndon of New York?

Ms. **Lyndon**. Here.

Senator **Stafford**. Mary, I understand you were instrumental in putting this panel together. I thank you.

Douglas Blazey of Pennsylvania?

[Mr. Blazey raised hand.]

Senator **Stafford**. Susan Brand of Massachusetts?

Ms. **Brand**. Here.

Senator **Stafford**. Dennis Abrams of West Virginia?

Mr. **Shipley**. Senator Stafford, Dennis Abrams is not appearing. I am appearing for him. My name is Ron Shipley. S-h-i-p-l-e-y. I am an assistant attorney general with the State of West Virginia.

Senator **Stafford**. This would be of particular interest to Senator Randolph. He is always interested in anybody from West Virginia. Is Mr. Kinder of New Hampshire here?

He is not. In that event, I am asking you please to stay within the 10-minute limit or even less since we have two more panels after you have completed to go through this afternoon. Why don't we go in the order in which you are listed? That means Mr. Tedford, assistant attorney general, Hartford, Conn., you would lead off.

STATEMENT OF KENNETH TEDFORD

Mr. **Tedford**. Mr. Chairman, I am assistant attorney general for the State of Connecticut, representing the Connecticut Department of Environmental Protection.

It would not be an exaggeration to say that the actions of the 97th Congress on the Clean Air Act are of critical importance to the environmental and economic well-being of the State of Connecticut and its citizens. The Clean Air Act has significant impact on many different economic, governmental, and population sectors of Connecticut. Some impacts are more subtle, complicated, and obscure than others; but the stakes are high in such important areas as: Economic development, transportation systems, energy policy, urban and rural balance, and governmental cost-effectiveness.

In offering the following comments and recommendations, the State of Connecticut expressly disavows any intent to "gut" the act, but rather seeks changes to make it work better to achieve the objectives it was originally intended to pursue. Connecticut values clean air and has demonstrated its leadership over the past decade in controlling air pollution effectively.

However, Connecticut's commitment has not been shared nationally and we find ourselves at intolerable economic, energy, transportation, and fiscal disadvantages relative to other States.

These disadvantages stem from the inequities in the law and its administration as well as our accident of location.

Connecticut has been forced to file several actions against a sister State, EPA, and utilities as a result of EPA's failure to address interstate air pollution, a crucial Federal issue.

Connecticut has petitioned the U.S. Courts of Appeals for the Second Circuit to review a final rule of EPA in approving a special limitation under the New York State implementation plan which allowed Consolidated Edison of New York to use high sulfur content fuel oil.

EPA, in approving the State implementation plan, failed to require under section 110(a)(2)(E) of the act the plan to contain adequate provisions insuring compliance with the requirements of section 126 of the Air Act relating to interstate pollution abatement and further failed to assess the aggregate impacts of sources of sulfur dioxide in New York upon the ambient air quality of Connecticut. This case was argued on February 4, 1981, but a decision has not been rendered.

Connecticut has further petitioned EPA under section 126 of the act to find that the use of higher sulfur fuel oil in generating facilities of both Long Island Lighting Co. and Consolidated Edison under proposed revisions to the New York implementation plan would have a substantial impact on the air quality of Connecticut. The hearing on such petition was held in December of 1980 and, to date, EPA has yet to render any decision.

LILCO had a prior special limitation to use higher sulfur fuel which expired in May of 1980. It has continued to use such fuel in violation of the federally approved New York State implementation plan although Connecticut gave notice to EPA and the State of New York of such violation requesting they take immediate action to halt such violations.

EPA, New York, and Long Island Lighting Co. have not taken any corrective action which then force Connecticut to institute a citizens' suit under section 304 of the act to enjoin such violations. This action was brought in the U.S. District Court for the Eastern District of New York, and is awaiting an answer from the defendants in such action.

Connecticut on June 19, 1981, testified at a public hearing before the Environmental Protection Agency in support of a New York and Pennsylvania section 126 petition to abate interstate air pollution from specific sources in the States of Illinois, Ohio, West Virginia, Indiana, and Tennessee.

Connecticut does not take delight in filing such a petition against sister States or in Federal court. It is EPA's one action in dealing with Connecticut to take such actions.

The act establishes, in theory, a Federal-State partnership to achieve national air quality goals through programs developed and implemented by each State in accordance with its particular needs and priorities.

Unfortunately, both the law and its administration have strayed from this concept considerably. The "partnership" terms are dictated by the "senior partner" [EPA] with precious little discretion left to the States. The burden of achieving national air quality goals is falling disproportionately on some regions of the country, particularly the Northeast.

The States are increasingly asked to respond to important national goals other than air quality, without the flexibility to achieve workable balances among these competing objectives.

EPA has taken an excessively legalistic approach to its role under the Clean Air Act, preferring to attempt to guarantee absolute compliance with all applicable rules and "guidelines" before permission to go forward with any program element is granted. This involved EPA in every aspect of State program administration, including routine day-to-day decisionmaking, looking over the States' shoulders.

The decentralization of EPA'a authority results in the act being interpreted in different ways, and with different emphases, in each of 10 regions. The practical result is that the rules are not the same for different States. The role of geography exacerbates this administrative inequity.

Because of the law's reliance on a "clean it where you find it" approach, some States can permit virtually unrestricted emissions and export the resulting air pollution to downwind States which must then try to make up for the burden that the prevailing winds bring.

The situation is so extreme that a recent National Commission on Air Quality study estimated that completely shutting down all Connecticut factories and motor vehicles would still not result in attainment of the ozone standard in Connecticut.

While there are numerous detailed policy and technical issues which the Congress will be asked to consider as it deliberates over the reauthorization of the act, two aims should be pursued above all others. Both the existing law and any proposed changes must attempt to be consistent with the following two principles:

Air quality laws and regulations should result in equal impacts on each State and should be enforced equally and equitably throughout the Nation. Each State should be subject to the same program requirements. Each State should be held responsible for regulating only that portion of its air pollution burden which it generates. Control requirements for similar facilities should be similar nationwide. No State should be asked to make sacrifices that other States do not have to make.

EPA should carry out a more appropriate Federal role and permit the States maximum discretion as to how they meet the requirements to which they are subject. This means granting overall timely approval of State air quality programs followed by a postaudit oversight of State program administration and air quality results. EPA should concern itself with public health/air quality impacts of national energy policy and acid precipitation.

It is not Connecticut's intention to support any general relaxation of air quality standards or any retreat from the public health objectives of the Clean Air Act. Rather, Connecticut believes that the burden of attaining these important national objectives should be shared equitably by all States, all regions, all sectors of the economy, and all levels of government. Each of the issues discussed below addresses an aspect of the existing program which is presently inequitable in one or more of these respects.

Each State should be responsible for controlling emissions of in-State sources only, not for compensating for emission carried into the State by prevailing winds. EPA permits the use of a "design value" for ozone that excludes at least some out-of-State emissions. No similar approach is permitted for other pollutants, nor is "imported" ozone completely excluded from any State's cleanup agenda.

Conversely, States or metropolitan areas which contribute significantly to air pollution elsewhere but do not record violations themselves are exempt from many requirements to which the recipients of their emissions are subject.

A source-based approach, as it might be called, would eliminate, or at least alleviate, the most grievous of these inequities. It would, it is recognized, result over the long term in somewhat higher ambient air pollution levels in States downwind from the Nation's most developed and industrialized areas than in less developed areas. Such States would have the option of adopting additional air pollution control measures if they wished, but the balancing of air quality and economic objectives would be their responsibility and would be responsive to local values and priorities.

The reconciliation of national energy policy priorities with national environmental policy should be accomplished at the national level.

For example, under the present circumstance, a State in which a powerplant is ordered to convert to coal has two equally unattractive options. It can require the plant to comply with a similar emission level as with oil, which will impose higher costs of retrofitting on already burdened utility customers without corresponding savings.

Alternatively, the State could permit conversion to coal without stringent emission limits and find itself with no margin for growth in emissions from new or expanded sources which afford greater economic benefits.

If the Congress believes it is in the national interest to burn more domestic coal by requiring fuel switching at existing installations, then the Nation should share in the financial and environmental costs of accomplishing this national goal.

Uniform requirements should be imposed on the coalburning powerplants and/or coal washing should be required. The costs of retrofitting existing plants to burn coal in compliance with uniform standards should be shared nationally, and any emissions increase should be exempt from the prevention of significant deterioration limitations.

Senator STAFFORD. Mr. Tedford, you have consumed 10 minutes. Could you complete your testimony, please?

Mr. TEDFORD. I will go into the conclusion, Senator. All of the views discussed in the written submission are aimed at reducing the burden imposed by the Clean Air Act. This burden is heaviest in the Northeast because of its location downwind of major sources, its closely spaced urban areas, its heavy dependence on oil, and its early commitment to air pollution control.

The burden of other national policy priorities which require substantial public and private investments also falls most heavily on the Northeast.

National energy policy requires conversion from oil, oil to coal, and the hazardous waste management program, among others. These national policy burdens come at a time when the Northeast is also disproportionately burdened by the increase in world oil import prices, when industrial modernization investment is concentrated elsewhere and older Northeastern plants are phased out and when State and local physical capabilities are particularly stressed.

Perhaps the Northeast would not be viewed by the rest of the Nation as having its hand out if it were not for the disproportionate share of the burden it bears for achieving national energy, environmental, and economic policy goals.

I would like to thank you, Senator, very much, for the opportunity to present this testimony.

Senator STAFFORD. Mr. Tedford, we are very grateful for you coming up here and helping us with this problem the committee is facing this year, which we think is crucial to the New England States.

The next witness will be Mr. Hluchan, deputy attorney general of Trenton, N.J.

STATEMENT OF RICHARD M. HLUCHAN

Mr. HLUCHAN. Good afternoon, Mr. Chairman. My name is Richard Hluchan. I am the deputy attorney general to the State of New Jersey.

Mr. Chairman, the State of New Jersey welcomes this opportunity to present its views on the problems of interstate air pollution. I would briefly like to address three aspects of our testimony which are set forth in full in the written testimony that has been filed with the committee. They are the matter of interstate air pollution abatement mechanisms; the matter of ozone transport; and the matter of acid deposition or acid rain.

It is our position that as contemplated by the act, the U.S. Environmental Protection Agency appropriately has the primary responsibility to mediate and to determine interstate air pollution disputes. Section 126 of the act, which was enacted as part of the 1977 anendments, provides an appropriate framework within which to address such problems. In our experience, however, section 126 suffers from a number of deficiencies which have hindered the EPA in fulfilling its role.

Among these deficiencies are, first, the time period for disposition of a section 126 petition are unrealistic, and the procedures for considering such petition are unclear.

Second, the statute is not broad enough in coverage since it only includes pollutants for which national standards have been adopted, thereby eliminating such phenomena as acid deposition, which is of particular concern to the State of New Jersey.

Finally, the statute does not provide adequate guidance as to what EPA can do substantively to resolve the problem once it is identified.

For example, the statute is silent as to how much interference with the State's prevention and significant deterioration or PSD program, will be tolerated.

My colleague from Connecticut has already addressed the Con Ed matter in which New Jersey, along with Connecticut, was a copetitioner. As set forth at length in our testimony, all of these deficiencies in section 126 are gleaned from that particular matter. I refer the committee to that.

We would, in summary, suggest that any revision of the Clean Air Act must address these issues in order that an effective interstate air pollution abatement mechanism be provided.

Next, I would like briefly to address the issue of interstate transport of ozone. While it may be possible to arrive at technical solutions to short-range transboundary air pollution, problems multiply manyfold when we look at the transport of air pollutants over distances of hundreds of miles or more.

Ozone provides the most obvious case in point.

It is clear that under commonly occurring weather conditions on the east coast, the session of peaks in ozone concentration downwind of metropolitan areas from Washington, D.C., to Boston shows that a mass of precursors and ozone is carried by the prevailing wind from one metropolitan area to the next along the northeastern coast.

Moreover, there is evidence of high levels of ozone and haze over large parts of the country associated with the movement of air masses across the country and of acid rain from sulfate and nitrate transport.

Some of the evidence in regard to ozone was submitted my the State of New Jersey last year in support of its position that substantial parts of the Eastern United States were designated improperly by EPA as attainment or unclassifiable, rather than nonattainment, for ozone.

EPA has yet to respond to that submittal, although as a result of a lawsuit brought by the State of New Jersey, it is under court order by the District of Columbia Circuit Court of Appeals to redraft its ozone designations.

At this point, Mr. Chairman, we have a short, 2-minute film which illustrates the transport of photochemical air pollution in the Northeastern United States. On July 2, 1974, primary emissions in the New York City metropolitan region and wind steadily blowing from the Southwest to the Northeast resulted in the transport of photochenical air pollution into central Connecticut in the early afternoon; into northern Connecticut in the late afternoon; and to southern Massachusetts in the early evening; and into northern Massachusetts in the late evening.

This film will indicate.

In the film, ozone concentrations at sites in New Jersey, New York, Connecticut, and Massachusetts, beginning on the morning of July 2, are portrayed by circles on a map of the Northeast. A clock at the lower right-hand corner of the screen, which you will see in a minute, shows the time of day. Larger circles mean higher concentrations of ozone. A circle the same size as the face on the clock has a concentration of 80 parts per million, which is the former ozone standard. The present standard is now 120 parts per billion, which is 50 percent higher.

The sequence on the film will be shown twice; in the first showing, time progresses more slowly than in the second.

Senator STAFFORD. Off the record.

[Discussion off the record.]

Mr. HLUCHAN. I did forget to mention that this film was done by Bell Telephone Laboratories in New Jersey. As I said, the clock in the lower right-hand corner of the screen shows the time of day. The circle is the same size as the face of the clock—have a concentration of 80 parts per billion. As they get larger, that indicates an increase in the ozone levels.

This is based on monitored data at these respective sites. Perhaps you can call out the time. I can't even see it from here.

VOICE. Six o'clock.

Mr. HLUCHAN. This is 6 o'clock in the morning.

VOICE. You can see over there the larger circles. These are the monitors and the readings by the monitors.

Mr. HLUCHAN. The time now is about 9 o'clock. As the Sun is increasing in intensity, the reaction is taking place. It is now about noon?

VOICE. Now it is about 1 o'clock. You can see how it is moving up in this direction and getting larger.

Mr. HLUCHAN. You can note how the circles in the southern part are getting larger as the day goes along. They will reduce in size as the circles in the upper right-hand corner become larger, thereby indicating the transport of the ozone as the day goes on. The circles in the northern part of Massachusetts and in Connecticut are getting larger.

VOICE. It is 6 o'clock.

Mr. HLUCHAN. What is the time, now?

VOICE. It is now about 8 o'clock in the evening.

Mr. HLUCHAN. In the New York area, the ozone is diminishing; it is still growing in the upper reaches of Massachusetts. This film was done by the Bell Telephone Laboratories based on actual monitored data for July 2, 1974.

Again, the size of the—you will see it now in the quick replay; the size of the clock at the 80 parts per billion level.

VOICE. At 9 o'clock in the morning.

Mr. HLUCHAN. As you see, the circles begin to get quite a bit larger than the face of that clock.

VOICE. It is 11 o'clock at night.

Mr. HLUCHAN. Mr. Chairman, if I have a few moments remaining, I would like to sum up with our third point, which is on the acid rain issue.

The problem is actually a whole range of problems due to the phenomenon of atmospheric deposition. Much of the debate on this issue is focused on the question of whether we risk investment of capital to reduce the precursors of acid rain when we don't know precisely how much reduction is necessary to solve the problem.

Looking at the problem from the other standpoint, New Jersey believes that there is sufficient evidence to demonstrate that by allowing acid deposition to continue unchecked, we are posing a severe risk of damage to the environment. The concept of risk, of course, embodies uncertainty. New Jersey submits, however, that the proper focus for the debate is to acknowledge this uncertainty and consider what reasonable measures may be taken which minimize the risks on both sides of the issue.

We believe that what we know now, at the risk of irreversible damage to our aquatic ecosystem, and the most likely causes of that action, compel us to take immediate but reasonable steps to mitigate these effects.

Attached to my testimony are a number of charts which I won't summarize now, but which are summarized in the written testimony, and which take us to, we believe, point us in the direction of a reasonable and equitable strategy for addressing the acid rain problem.

New Jersey submits that we can begin to define the parameters of a reasonable, cost-effective approach to mitigating the acid rain problem. When defining a cost-effective strategy, we must insure that we take into account the impact on coal mining jobs and the economics of the Midwestern coal-producing States. With these considerations in mind, we propose that a mitigation strategy could be designed as follows: First, the strategy should focus on achieving a 15- to 20-percent reduction in sulfur oxide emissions originating throughout the entire region east of the Mississippi.

Next, the strategy should allocate specific emission reductions on a State-by-State basis.

Third, the emission reduction targets should be established by identifying those States which exceed a specified emission rate per capita, based on fossil fuel fired utility emissions.

Next, those States above the emission rate per capita cut-point should be required to achieve a specified percentage reduction in total statewide emissions.

Next, each State should be allowed to devise its own strategy for achieving the assigned emission reduction target; and finally, require that all emission reductions be achieved through the application of air pollution control technology such as coal cleaning or flue gas desulfurization. In response to this approach, Senator, you will hear the argument that we should do our research now and then solve the problem later. Those who might bear the cost of mitigation strategy will argue that without more precise knowledge about the cause-and-effect relationships, we are risking the investment of capital without the assurance of commensurate benefits.

New Jersey believes that even in the worst of circumstances, we will be risking the investment of a few million dollars, but the rewards of success are great—healthy lakes, reduced visibility impairment, and reduced risk of toxic contamination of our drinking water supplies.

Those who argue against this approach are saying, in essence, that we should experiment with our lungs and lakes rather than risk any excess cost to industry.

New Jersey will continue to pay special attention to the progress of the committee's investigation of long-range transport and other complex air quality issues associated with interstate pollution. If you have any need for additional information, our department and our department of environmental protection stand ready to cooperate.

I thank you for you attention.

Senator STAFFORD. Thank you very much, Mr. Hluchan, indeed.

The next witness will be Mary Lyndon, assistant attorney general of New York.

STATEMENT OF MARY LYNDON

Ms. LYNDON. Good afternoon. My name is Mary Lyndon. I am here speaking for Robert Abrams, attorney general for the State of New York.

Although the 1977 amendments to the act direct EPA to control interstate air pollution and gave it ample authority to do so, EPA has failed to heed this mandate. EPA has avoided the problem by interpreting its authority so narrowly that it appears to be unable to regulate interstate pollution at all.

New York has had considerable experience in trying to get EPA to address one of the most pressing interstate pollution problems: Sulfur dioxide and particulate emissions from large Midwestern powerplants.

I will first describe New York's efforts on this and then suggest two complimentary legislative proposals.

In January of this year, and again in March, the attorney general of New York filed with EPA formal petitions concerning the emissions of 24 large powerplants in six Midwestern States. New York requested EPA to disapprove pending SIP revisions which would increase allowable sulfur dioxide emissions by those powerplants. We pointed out to EPA that the language of sections 110(a)(2)(E) and (a)(3) of the act requires EPA to make a determination that there will be no adverse interstate impacts in violation of the act from a SIP or a SIP revision.

New York also requested EPA to perform a broad assessment of the cumulative effects of Midwestern emissions. We did this because EPA has never conducted an overall review of the SIP's for their interstate effects, even though this was clearly contemplated by the 1977 amendments to the act.

Since New York filed its petitions, EPA has since approved a number of the SIP revisions without assessing their interstate impacts. We are now seeking review of EPA's action in the Federal appellate courts.

In the meantime, EPA has ordered a hearing, pursuant to section 126(b) of the act on the impacts of emissions of 19 of the plants which were the subject of New York's original petitions.

The hearing was held jointly with Pennsylvania on its section 126 petition respecting about 30 sources. EPA defined the scope of this hearing so as to preclude consideration of the impacts of the total emissions allowed by the SIP's of each of the source States and to avoid consideration of sulfate effects and acid deposition and precipitation. EPA claims to have no authority to consider sulfate pollution on acid rain without an NAAQS directed at these pollutants.

The hearing was held on June 18 and 19. New York, Pennsylvania, Massachusetts, the Province of Ontario, and many other interested parties submitted extensive testimony. The record will remain open for most of the summer and interested persons may submit written comments to EPA.

With respect to the reauthorization of the act, New York proposes a two-pronged legislative approach. The act as it is presently written contains an adequate structure to deal with most interstate problems, if they are addressed through the act's processes from the onset of the problem. We propose to retain the act's processes essentially as they are, with only a few changes. However, for those serious pollution problems which have gone unchecked during the past years, New York proposes direct immediate legislative action.

With regard to clarification of the interstate control provisions, the act now contains three basic processes for controlling interstate pollution. New York's proposal is simply to make each one more explicit.

First, the States and EPA must each have clear responsibility to prevent interstate problems, through careful SIP preparation and review.

Second, it should be made clearer that it is EPA's responsibility to establish NAAQS which incorporate interstate considerations, including meteorological transport patterns, transformation in the atmosphere and synergism, and the impacts of different deposition mechanisms, such as rain.

Third, each affected State must have a right to participate in a finding of adverse impact from any out-of-State pollution. Congress should revise section 126 so that pollutants which are not presently covered by section 126(b) may be the subject to a State's section 126(b) petition. EPA should regulate any pollutants which cause serious problems which are regional, rather than only addressing national problems. Also, section 126 should explicitly require EPA to set standards to abate interstate pollution, even when EPA cannot quantify the extent of the problem or establish exact source-receptor ties. EPA should be required to abate an identified interstate pollution problem by setting a technology-based emission standard, established on a basis of equity among the States.

Apart from enlarging the scope of section 126, these proposals would leave the act basically the same. However, we also need direct controls on emissions which are now causing interstate pollution. New York urges the adoption of measures to reduce sulfur pollutants emitted by Midwestern powerplants. Many of these plants are very large and many exercise little or no control over their emissioms. New York controls its emissions very strictly. The Midwestern States should do likewise. New York's Attorney General supports a national or regional emissions cap or regionally targeted sulfur dioxide rollback provision. We also urge Congress to mandate immediate controls on ozone precursors, notably hydrocarbons.

This concludes my oral testimony. The Attorney General of New York will submit to the committee proposed legislative language articulating these general proposals. We will also address in our written testimony some of the issues raised here today by the witnesses from EPA and the GAO.

Thank you.

Senator STAFFORD. Thank you very much. The next witness will be Mr. Douglas Blazey, chief counsel of the Department of Environmental Resources, Office of the Attorney General at Harrisburg, Pa.

STATEMENT OF DOUGLAS BLAZEY

Mr. BLAZEY. With your permission, I would just like to hand you the exhibits. I have to retype the text. I think it would be clear for everyone if I did that and then handed it in.

Senator STAFFORD. Sure.

Mr. BLAZEY. My name is Douglas Blazey. I am the chief counsel to the Pennsylvania Department of Environmental Resources. The department is pleased to have this opportunity to appear before you today.

Since 1977, the Commonwealth, through the department, has attempted to have the U.S. EPA implement the interstate pollution abatement provisions of the Clean Air Act.

To date, EPA has not, it can fairly be said, taken any affirmative action to reduce interstate air pollution and has never taken a long-range transport phenomenon into account when making regulatory decisions.

The conclusion we have reached is that various political, institutional, technical, and judicial factors have all combined to frustrate the intent of Congress in regards to these particular sections of the Clean Air Act. The SIP or State implementation plan process has been an utter failure when it comes to preventing interstate pollution.

A new policy is needed. One such policy is that proposed by the National Governor's Associations. There are others such as emission caps or the installation of reasonably available control technology on existing sources.

After the Clean Air Act Amendments of 1977, Pennsylvania specifically requested EPA to evaluate for compliance with interstate pollution abatement provisions of the act, provisions then being proposed to the Ohio and West Virginia State implementation plans.

Specifically, Pennsylvania wanted EPA to examine the cumulative impact of allowed SO_2 emissions from upwind States on ambient air quality in western Pennsylvania, both as direct SO_2 and as a sulfate, a secondary component of total suspended particulate.

To date, EPA has declined to make the required determinations.

It justifies its actions by stating that it has conducted research concerning the long-range transport of air pollutants, and that the state of the art dispersion modeling does not enable EPA to adequately assess long-range impacts in its regulatory decisions.

This is EPA's position in approving an SO_2 emission relaxation for the Mitchell and Harrison powerplants in West Virginia and the Cleveland Electric Illuminating Companies leak and Avon Lakes in Ohio. EPA's planning process works on the assumption that one can determine, over short distances, the impact of emissions from one source to any receptor point and that favors employing this direct cause and effect analysis.

Thus its State implementation plan approval for large SO_2 sources is based on a determination that the sources emissions do not cause violation of the national ambient air quality standards in the local area.

It is difficult, but not impossible, to integrate into this approach cumulative impact or source intensification effects and various long-range transport considerations, which also involve the atmospheric conversion of primary pollutants into secondary pollutants.

While EPA may genuinely believe that one cannot precisely quantify the contribution of a single source of SO_2 emissions in one State to the SO_2 sulfate and acid rain problems in another State, this view does not negate the fact that SO_2 emissions in one State individually and collectively are being transported long distances downwind, affecting air quality in other States.

Nor does the complexity of this issue alter EPA's legal responsibility to protect air quality in these neighboring States. Since EPA's current approach does not adequately comply with the provisions of the Clean Air Act, we have challenged these and other EPA decisions in the courts of appeals, in an attempt to secure judicial determination that EPA has not adequately assessed interstate pollution impacts.

Progress through the courts has been slow. We are now beginning our 4th year of litigation. I have attached chronologies of the longer standing actions. At present, Pennsylvania has filed four petitions for review in the courts of appeals, and has also filed a 126 petition in December of last year.

That hearing was referred to me by Mary Lyndon.

The Clean Air Act as presently configured has not resulted in the control of interstate pollution. It is not likely to for several reasons: First, political commonsense argues for each State to favor its own parochial interest over that of its neighbors. The SIP's are prepared by each State government for its domestic use.

Even though the Clean Air Act requires each State to consider the impact of its sources upon its neighbors, officials in the initiating State are not politically accountable for air to out-of-State neighbors.

Consequently, there is also incentive to limit emissions below those minimally necessary to achieve ambient air quality standards within the local jurisdiction.

Second, institutional factors are such that the U.S. Environmental Protection Agency is unlikely to reject the State SIP because it does not evaluate and control the extraterritorial effects of sources within the State. The States which prepare the SIP's in the first instance have detailed information only with regard to their own sources and the impact of these sources upon attainment of ambient air quality standards within their State.

No single State is likely to make a substantial and uncompensated effort to first gather and then incorporate source and ambient air quality data from its neighbors to its own SIP planning process. Thus each State SIP is generally silent as to its impact on its neighbors.

EPA, in conducting its review of these SIP's, is not likely to look for problems that are not described in the SIP.

Furthermore, the Pennsylvania National Monitoring System is not designed to identify or even locate air pollution crossing State boundaries.

Unless a State collects the data, it does not exist. If EPA were to begin assessing interstate transport, it would have to collect more data; it would have to utilize long-range modeling; and it would have to employ concepts of equity.

Third, the technical realities are such that long-range dispersion modeling is both more difficult and less precise than shorter ranged dispersion modeling. If EPA is looking for a source-receptor relationship which it can document with certainty, say, for example, between a source in Illinois and a receptor in Vermont, it whll never find it.

Since complex and costly SIP challenges often occur over every SIP in the Midwest that does not allow maximum emissions from each source, it is, therefore, understandable why EPA has become very conservative in all its technical assumptions.

Without a new approach, it is unlikely that EPA will tell Midwestern officials that they must utilize a multi-State analysis which considers hundreds of sources and the long-range impacts of those aggregated sources upon another and perhaps remote State's air resources.

Although this result is required by the act, it has not been implemented and has resulted in costly and protracted litigation.

Finally, the judicial process is such that neither the State courts nor the Federal court of appeals can be expected to unscramble this technical stew. EPA has avoided confronting the problem of interstate pollution through requests for remands; reconsideration of established policies; and a need to review new or additional source-generated data. These requests have kept the courts from deciding the fundamental legal issues in the interstate dispute.

Two further points based upon our experience with the litigation and petition process: First, as the master of the rulemaking proceedings, EPA can take a protracted period to issue a final action.

EPA took 4 years to consider, reconsider, suspend, revise, and repromulgate various SO_2 emission limitations with the two Cleveland illuminating plants in Ohio referred to in the attached chronology.

Until EPA issued a final action in these two cases, we, as aggrieved States, have no recourse but the courts. We cannot seek judicial review of an action which the Administrator claims he or she is still considering. Second, even when a final action is promulgated, EPA may withdraw the matter from judicial scrutiny by asserting that the Administrator is reconsidering or suspending the decision.

After Pennsylvania filed its petition for review in the West Virginia matter and had filed its brief, Pennsylvania requested a remand from the case to restudy certain technical issues within 90 days.

The 90-day remand lasted 18 months. Thus, judicial review of the major issue, interstate pollution, was circumvented by a remand on minority issues. We are still waiting to hear it.

Senator STAFFORD. Mr. Blazey, can you summarize? It is a little bit over 10 minutes.

Mr. BLAZEY. Yes, sir. We would consider that of various openings for the committee to consider, there are three in mind: First is the position advanced by the National Governors Association. The second position would be the notion of a regional or territorial emission cap; and finally, the concept of the application of a reasonably available control technology strategy.

We would defer from the cap, in that it might not have uniform limits.

We hope that our experience in attempting to identify and obey interstate pollution will aid the committee in considering the reauthorization of the Clean Air Act.

Thank you for allowimg me to appear before you.

Senator STAFFORD. This will help us, Mr. Blazey. We really appreciate your being here.

The next witness will be Assistant Attorney General Susan Brand of the Commonwealth of Massachusetts.

Susan, you are on.

STATEMENT OF SUSAN BRAND

Ms. BRAND. Thank you, good afternoon, Senator. I appear today to address a serious and growing concern to Massachusetts and the other northeastern States; the long range transport of sulfur dioxide and the chemical transformation of sulfur dioxide over long distances into sulfur particulates, and also to address the need for Congress in reauthorizing the Clean Air Act, to insure that we begin to remedy this problem as soon as possible.

In our view, unlike some of the witnesses who have testified here today, the scientific community has already developed sufficient evidence to establish that sulfur derivatives are being transported by the prevailing winds from the heavily industrialized Midwest to the Northeast, and that sufficient damage is being done in the Northeast with respect to sulfate pollution and acid deposition to warrant action now.

This long-range transport is causing or contributing to nonattainment of national ambient air quality standards for total suspended particulates in Massachusetts. It is also creating serious problems for the health and economies of Massachusetts and the rest of the northeast.

In *Massachusetts* v. *EPA*, which is now pending before the Sixth Circuit Court of Appeals, we are currently challenging EPA's interpretation of its duties to determine interstate impacts in the context of the State implementation plan review and approval process.

Our involvement in this case, and in various other administrative proceedings under the Clean Air Act, has taught us how the act may be improved to insure that these concerns about long-range transport are addressed.

My remarks today will focus on our experience in this litigation to the extent that it reveaks a need for changes in the act and those changes that we believe Congress must make if adequate protection is to be afforded for the Northeastern States.

As other witnesses have indicated, the major impediment to the abatement of interstate air pollution to date has been EPA's own unwillingness to address this issue. In 1977, when Congress last amended the act, it required EPA to confront this issue effectively while recognizing that EPA's interpretation of prior law had in large part prevented an adequate answer to this very same problem up to that time.

Accordingly, as an important part of the 1977 amendments, Congress required EPA to make certain determinations about long-range impacts when reviewing a new or revised State implementation plan. It also provided a mechanism in section 126 of the act for States to receive information about sources of potential interstate pollution and to petition EPA to resolve problems concerning interstate pollution.

Lastly, Congress required EPA to go back and review all existing State implementation plans with respect to their interstate impacts.

Although in our view the 1977 amendments provided a sufficient mandate to EPA to address the interstate pollution problem that brings us here today, EPA's lack of will to do so has totally stymied any efforts in that direction.

In the 4 years since the amendments, EPA has failed to make any determinations regarding interstate impacts in reviewing and approving State implementation plans; it has dragged its feet in acting on section 126 petitions; and it has never conducted the mandated overall review of existing State implementation plans.

The proceeding *Massachusetts* v. *EPA* provides a good case study of EPA's failings in the SIP review context. Mr. Blazey has already mentioned this case which involves two Cleveland Electric illuminating powerplants. Here EPA proposed to approve a fourfold relaxation of sulfur dioxide limits for two major powerplants near Cleveland, Ohio, despite serious reservations about the adequacy of the relaxation to meet air quality standards.

Emission limits much stricter than those being met at that time were already approved and were slated to go into effect in October 1979. Various commenters urged EPA during its administrative review to determine the interstate impacts of this proposed relaxation because of the very serious potential that it create for increased SO_2 conversion and transport and for acid rain.

EPA, however, in June 1980, ignored these concerns and made no determination whatsoever with respect to interstate impacts, while approving a threefold increase. Massachusetts has sought review of this decision, primarily the interstate impact of it.

The case is still pending in the court of appeals. In papers filed with the court, EPA still has not provided adequate justification for its omission with regard to the long-range impacts.

It has stated only that it is not required to consider impacts on sulfate particulate levels and that its models are not adequate to predict long-range impacts.

Given EPA's consistent and continued refusal to take on the responsibility that Congress has already imposed, we urge this Congress to take a direct approach to remedy interstate air pollution and to provide more specific direction to EPA in this regard.

We propose the following amendments to the act: First, that reasonably available control technology be applied uniformly to all major sources of sulfur dioxide, and second, a proposal advanced by the National Governors Association that EPA be required to designate regional transport corridors which shall include all source and receptor States and we shall be designated for sulfur compound emissions, as well as for ozone precursor emissions and any other pollutants deemed appropriate. EPA should be required to establish a corridor on its own initiative or upon petition of a State.

EPA would also be required to establish for each corridor, regional emission caps within a specified time period after designation of the corridor and subject to revision downward at a later date if available evidence indicated that such is necessary. Within a specified time period following the establishment of an emission cap, States within the corridor would then submit to EPA a plan specifying how they would meet the cap.

This double approach has several advantages: the first part, the application of reasonably available control technology, provides a direct, immediate step by Congress that will significantly reduce sulfur emissions without creating a complicated regulatory scheme that may give rise to the prolonged litigation and delay that we have seen thus far; and by applying RACT across the board to all States, the burden of controlling pollution would be borne in an equitable manner.

Second, by providing for regional corridors and caps, several objectives will be accomplished. A State can initiate the establishment of a corridor and emission rather than leaving it simply to EPA. Controls that are stricter than RACT can be applied as necessary.

A State will have the discretion to decide how to allocate emission limits and meet the cap within its borders.

And finally, those interstate problems that arise from a variety of pollutants other than sulfur components, notably, ozone precursors, can also be addressed more effectively.

I thank you for this opportunity to give you Massachusetts' views on the problem of interstate air pollution. We hope that Congress will supply the impetus and direction that EPA has thus far failed to show in this area.

Senator STAFFORD. Thank you very much.

Once again, I think your testimony demonstrates that this committee has tried to strhke a balance in the witnesses that appear before it. Because if any of the EPA representatives who were here earlier are still here——

They have been castigated many times before this committee by witnesses who said they have done far too much. Now we have a witness who said they haven't done enough in this particular area, which just proves that none of these problems are very simple and that we are trying to get all the viewpoints in helping us to come to final resolutions.

The final witness from the attorneys general panel will be Mr. Ron Shipley, who is representing Dennis Abrams, deputy attorney general, Charleston, W. Va. Mr. Shipley, are a part of the office?

STATEMENT OF RON SHIPLEY

Mr. SHIPLEY. Yes, sir. I am an assistant attorney general, specifically assigned to work on air pollution problems.

Senator STAFFORD. Very well. Why don't you change places with Mr. Blazey so we can hear you better?

Mr. SHIPLEY. Mr. Blazey and I were just commenting on how strange that would be if we, in fact, exchanged places.

Good afternoon. I am Ron Shipley, an assistant attorney general representing Chauncey H. Browning, attorney general of West Virginia.

It is a privilege to be here today to discuss the interstate provisions of the Clean Air Act.

At this time, when the Clean Air Act is pending reauthorization and there is much discussion of decreasing the Federal role on air pollution control, we are here to tell you that section 126 must not be weakened.

Indeed, depending on the outcome of this year's authorization, the interstate pollution abatement may even need to be expanded. It is difficult to put forth proposals to amend section 126 of the act when we are not sure how or whether other provisions of the act will be changed.

The Clean Air Act is an intricate, interrelated piece of legislation, but to the extent EPA's role is reduced in favor of greater State control, any interstate pollution abatement mechanism in the act intenddd to help the States resolve interstate pollution problems must be broadened.

West Virginia has filed a section 126 petition and is presently defending against two of them. Apparently, we were the first State to ever file a section 126 petition. We are involved in litigation in the Third Circuit Court of Appeals concerning the interstate SIP provisions, section 110(a)(2)(e). We know section 126 is an important mechanism for trying to resolve an interstate air pollution problem.

Our experience in filing section 126 petitions is limited because we never got to the hearing stage. After we filed the section 126 petition against the SAMMIS power station in Ohio, we intervened in an EPA enforcement action against SAMMIS and achieved the intended results.

But this experience, coupled with our present defensive posture concerning New York's and Pennsylvania's recent section 126 petitions has shown us how 126 works.

For simplicity of discussion, there appears to be two kinds of interstate air pollution problems: The first is the situation we encountered at SAMMIS; that is, a direct and readily traceable short-range interstate pollution problem.

The existing Clean Air Act, with certain clarifications, addresses this situation adequately.

The SAMMIS power station situation is ideal for a section 126 petition. In that situation, we petitioned against a single source whose impact on West Virginia was visible and easily traceable. Mathematical modeling was not necessary. We merely monitored air quality and took pictures of the SAMMIS plant's plume originating across the Ohio River and depositing air pollutants on the hills of West Virginia.

At the other extreme, however, is the Northeastern States' problems with not easily traceable long-range transportation of a pollutant—that is, sulfates—which is not included in the national ambient air quality standards, PSD, or visibility requirements.

Section 126's usefulness for either of these situations and especially the more complex problems such as New York and Pennsylvania petitions is complicated due to uncertainties over key questions and the difficult technological issues involved.

Initially, we urged Congress to clarify the existing section 126, to enhance its usefulness by States and political subdivisions. Those areas needing clarification include (1) who has the burden of proof; (2) what must a petitioning State show to trigger the EPA investigative process; (3) whether sources can be aggregated; and (4) what is a major source.

First, Congress should specify that EPA, not the petitioning State, has the burden of showing impermissible interstate effects. The law already implies this burden since EPA must undertake the rulemaking. However, there have been many questions raised concerning the burden of proof, especially in light of the limited time period of 60 days in which EPA must act. Some say this short time period implies that the petitioners must come to EPA with a conclusive case showing impermissible interstate effects. We do not agree.

EPA has the burden to investigate the legitimate interstate pollution claim. While the ultimate burden is on EPA, the State or political subdivision must come forward with minimum showings of a legitimate interstate pollution claim to trigger the investigative process.

We want to put some burden on the State to give all parties affected, including the named sources, enough information to show what impermissible impacts are occurring. Parenthetically, notice to the affected State and sources must be given when the petition is filed.

This will enhance the factfinding process, because other parties would know the specifics concerning the alleged interstate problem with enough time to comment meaningfully. Therefore, Congress should specify the minimum allegations a petitioning State or political subdivision must make to trigger the EPA investigative process.

These allegations should (1) show evidence of nonattainment; (2) show that nonattainment is contributed to in significant, not de minimis, amounts by an out-of-State pollutant, show that the nonattainment is not caused by in-State sources; and (4) show evidence that the nonlocal pollutants are from the named sources.

Third, we understand that the National Commission on Air Quality has recommended that the act be clarified to insure that sources can be aggregated for section 126 purposes. We support that recommendation, but only if it is made clear that aggregation of sources is allowed only after each individual plant is shown to contribute to interstate loadings.

If not, then that source should not be included in the aggregate.

We believe that the present law currently allows for this type of aggregation, but Congress should clarify its intent.

Finally, we believe it is important to define what is a major source for purposes of section 126(b). Currently, it is not defined, and everyone assumes that the major source definition from the PSD section applies.

But we also question whether any major classification is needed. If a source, large or small, is violating ambient air quality standards in another State, it also should be the subject of a section 126(b) petition.

For example, if the SAMMIS plant were not a major source, we would not want to be precluded from this forum. As we have indicated, if EPA's role in air pollution abatement is reduced, Congress must provide a convenient, practical forum for the States to resolve interstate problems.

Consequently, section 126 might have to be expanded beyond its existing limited scope of dealing with national ambient air quality standards, PSD or visibility problems, and other mechanism may be needed in the act.

This could be accomplished by adding a subsection to section 126(b). This new subsection would broaden the existing 126(b) mechanism consistent with the concept that one State can petition for a finding that an out-of-State source or sources contributes any pollutant in sufficient quantities to endanger public health or welfare.

If such expansion is written into law, Congress could then tie EPA action for a noncriteria pollutant which causes adverse public health or welfare impact into section 108, or Congress could allow EPA to set regional ambient air quality standards for that pollutant.

Finally, Congress might want to set up a negotiation—arbitration mechanism instead of the more rigid rulemaking process which now takes place.

The purpose behind these additional mechanisms is to avoid the inequitable nature of the current 126(b) petitioning process. New York's and Pennsylvania's petitions could lead to inequitable results if EPA grants the petitions and the named sources are regulated more stringently.

This is inequitable because the evidence indicates that the sulfate problem is truly regional and emanates from unnamed sources, as well as those included in the petition.

In conclusion, we support the 126(b) mechanism. We do not want to see it weakened; certain concepts should be clarified.

Finally, we want section 126(b) to become a better, more practical convenient forum which can provide equitable solutions to interstate air pollution problems.

Thank you.

Senator Stafford. Thank you very much, Mr. Shipley.

The committee has a number of questions that have occurred to us, and other members of the committee will have questions later on. Would it be agreeable to all of you if questions are submitted in writing for answers at your earliest convenience?

If that's true, and apparently it is—you are all shaking your heads affirmatively—we will do it that way with one exception.

Let me ask you collectively this question. Any of you who wish may respond or not, as you may be so inclined.

Is it your experience that political considerations enter into EPA's decisions to respond to complaints? Do you believe for this reason or others we should attempt to have an independent authority; that is, a Federal judge, for example, making decisions when it involves disputes between two or more States?

Second, should we create a cause of action for individual sources, not just for States? Does anybody care to comment on that? If you don't care to now, you may answer in writing.

I detect a certain reticence.

In the light of that, for the full committee, I am really truly deeply grateful to you for coming here. We do have a regional problem that affects all of our States. You have helped us.

The other members of the committee, I am sure, will be reading your testimony, and, in fact, Senator Mitchell of Maine is represented by a member of his staff here.

The Chair, at this point, I think, will declare a recess of 20 minutes in order to allow our overworked reporter to recover.

We thank you all very much.

[Brief recess.]

Senator **Stafford**. The Committee on Environment and Public Works will please come to order.

We are going to resume the hearing.

The next panel will be Mr. Brendan Whittaker, secretary, Agency of Environmental Conservation, Montpelier, Vt.—Mr. Whittaker was here earlier representing the Governor—Mr. Peter Fairchild, executive director, NESCAUM, Boston College, Weston, Mass.; and Mr. Maurice D. Arnold, member, State legislature, Whiting, Vt.

Shall we go in the order in which we called your names, gentlemen? That would be Mr. Whittaker would lead off.

STATEMENTS OF BRENDAN WHITTAKER, SECRETARY, AGENCY OF ENVIRONMENTAL CONSERVATION, MONTPELIER, VT.; PETER FAIRCHILD, EXECUTIVE DIRECTOR, NESCAUM, BOSTON COLLEGE, WESTON, MASS.; AND MAURICE D. ARNOLD, MEMBER, STATE LEGISLATURE, WHITING, VT.

Mr. **Whittaker**. Thank you, Senator Stafford.

I am going to depart from my written testimony, which I will submit, to say a couple of things informally, if I may.

The Governors and eastern Premiers met in Newfoundland, St. Johns, Newfoundland.

The Governor mentioned that in his statement this morning. I would like to correct what we think is an erroneous press story, or something that got out around parts of New England—not in Vermont, I found. I heard it on my own radio in Maine. Governor Snelling of Vermont and Governor Brennan of Maine had had some disagreement on the long-range transport issue. We checked with the Governor's office in Maine today, our own Governor's office today, and they didn't know either. Representatives of the six New England States and the five Provinces, Quebec not being there, took acid rain, long-range transport as a major problem to the region.

Governor Snelling, I might add, was the one who first raised it, much thanked by Premier Pickford of Newfoundland.

The gist was, the way governments have to act, but they have asked for a full report to be delivered to them at the next meeting next summer in Maine.

The Governor of Maine certainly concurred on that. Our own staff will be digging into that, and I am sure the other five States plus the Canadians. I myself, I will say I was with the Premier of Newfoundland and made contact with my counterpart, the Minister of Environment in Newfoundland found problems 800 miles away, remote, are taking long-range transport acid precipitation and national unbuffered problems very seriously. They are very concerned.

I have made contacts with my own staff with Newfoundland. I think Vermont should take the lead in that. I would like to give you Vermont's recommendations.

As John Easton, the attorney general, said, I would do on the Clean Air Act: First, we ask for immediate designation by the U.S. EPA of regional corridors for each long-range transported pollutant.

Second, in order not to increase the SO2 that is being placed in the atmosphere, we ask Congress to require mandatory coal washing or cleaning by all utilities burning more than 2 percent coal, with a no net emissions increase from oil-fired plants, which will be converting to coal.

Parenthetically, that is a concern of the maritime and U.S. provinces, converting to coal. Vermont feels strongly that the present new source performance standards for utilities should remain in effect as well as strict adherence to the no-credit-for-tall-stacks policy contained in the Clean Air Act.

Finally, as the case on zone transport—you have heard about that today. It has been well documented. It is our further recommendation that reasonably available control should be placed on all large sources to be defined, emitting volatile organic compounds on a nationwide basis.

As has been said before, there is no question that much more research is needed regarding long-range transport.

This research should be a high priority within the Federal Government, again, as indicated by the Governor. Again, though, there is sufficient data to take the initial actions in regard to these requests for national emission standards. I want to stress that the call for more research and evidence should not be used to avoid the long-range-transport issue.

Research should determine how much control and where it is needed; it should not be used to delay necessary controls.

Another issue that we find coming under attack is the PSD, the prevention of significant deterioration. I would like to say something on that.

Vermont strongly urges retention of the concept; that is, keeping areas with clean air clean—we have a stake in that—and the consideration of the air quality impact in future growth decisions.

Vermont, incidentally, is one of a handful of States that has been authorized to operate this program in place of the Federal Government. We do our own.

Vermont did not adopt the Federal regulations by preference, but we drafted our own State regulations which are consistent with the mission of the Federal Clean Air Act. We feel that the PSD can work as an administrative program to protect clean areas, but the heavy administrative burden under the present program must be radically changed in order to assure success.

Vermont concurs with the findings of the National Academy of Science that the problems associated with the PSD program in the past were due to the act being too narrowly interpreted.

The present Clean Air Act is in need of some specific language changes to clarify the intent of Congress, your Congress.

It is our feeling that some of these considerations on clarity should include: First, amending the act to make the PSD program applicable to any new source of air pollution of 50 tons per year; second, maintain the present increment system, but with the elimination of short-term increments; third, require that all sources of air pollution, new sources, be designed with the best pollution abatment technology; and fourth, retain the use of atmospheric diffusion models, but with specific limitations on their applicability.

It is our feeling that such a program should be retained to guarantee the long-term protection of the character of the State of Vermont, as well as other clean air States.

A third concern to Vermont relates somewhat to the long-range-transport issue of which we have heard much today, but at the same time is separate in importance. This is the issue of fine particulates.

There has been considerable reservation, both in the scientific and regulatory communities, on the validity of the TSP standard insofar as the standard did not take into account the fine particulates which are taken up into the respiratory tract, as we understand from the health people.

As EPA has now discussed this standard for a long time, Congress should mandate that EPA adopt a fine particulate standard as soon as possible in order to protect the public health. There is also a need to set secondary standards for fine particulates based on at least a visibility criteria. This could be set, again, on a regional basis.

Though there has been much concern about visibility loss in the Western States, there is sufficient evidence to demonstrate that Vermont also suffers from the same fate, and like many of our Western States, atmospheric visibility is important not only to our economy, but also adds to that special quality of life in the Green Mountain State.

Finally, Vermont has concerns about the relationships between the United States, EPA, and the States in the adoption and revision of the SIP's. Vermont fully supports both the position of the State and territorial air pollution program administrators and the

National Governors Association, NGA, on the necessary changes to the Clean Air Act to allow the States greater flexibility to operate the State air pollution control programs within the context and requirements of the Federal Clean Air Act.

However, this should not be construed that Vermont does not feel that the U.S. EPA should not have an overview function—we would like to change all the negatives; they should—in regard to the operations of the air pollution control program, including enforcement activities. To assure national and international equity, there must be a strong Federal role.

With the exception of the need for long-range-transport legislation, the basic concepts of the 77 amendments to the Clean Air Act remain well founded and sound. Much of the act should be retained in its present form with possible minor adjustments.

Based on the past history of the act, major changes in emphasis will result in prolonged litigation and an uncertainty to major new provisions to the act.

We urge you to proceed as quickly as possible in your deliberations in the Senate on the reauthorization of this most important environmental legislation.

Thank you.

Senator **Stafford**. Thank you very much, Mr. Whittaker.

The next witness is Mr. Peter Fairchild, executive director of NESCAUM, Boston College.

Mr. Fairchild, would you tell us what NESCAUM is, for the record, so that the people here will understand? I know that is important.

STATEMENT OF PETER FAIRCHILD

Mr. **Fairchild**. The Northeast States for Coordinated Air Use Management is a committee of State air pollution control agency directors, the chief clean air officers in six New England States, New York, and New Jersey.

Senator **Stafford**. Thank you very much.

Mr. **Fairchild**. I will introduce myself again for the record. My name is Peter Fairchild. I am the executive director of NESCAUM. NESCAUM is an active working committee of professional State officials dedicated to a solution of regional air quality problems through coordination, cooperation, and exchange of technical information.

I want to echo other comments that we have heard today in discussing long-range transport and not strictly acid rain.

Long-range transport of air pollutants is a major concern of our directors. We had believed that when the issue of acid rain caught the public eye, a year or so ago, that this would be the perfect vehicle to approach the Clean Air Act reauthorization, catch people's attention on long-range pollutants, and secure some modifications that we think are necessary to the act.

What has happened is that the rhetoric about acid rain, the controversy about models, the uncertainty about the data and so on, has included the need to deal with transported pollution in general.

I am very pleased that this hearing has focused on the general issue and that much of the testimony has pointed out that there is more than a single issue in transport of long-range pollution.

We look to this as a very important part of the act of reorganization, if I say nothing else today. We look at acid rain as one more, albeit a good one, one more example of the transport problem.

As I said, transport deals with acid rain and many other pollutants. I want to highlight some of the effects and problems we have from those pollutants in order to suggest some strategies for you to consider.

Sulfates and nitrates and other acid compounds get deposited by wet and dry processes in our region where they cause considerable environmental damage.

The transport of ozone into the Northeast causes repeated violations of national ambient air quality standards that were set to protect the public health, and the exceedence of these standards means that our States must apply stricter controls on our own local sources of hydrocarbons, primarily our local industries.

Transported sulfates and other pollutants in fine particle form are also a problem. They interfere with our ability to meet and maintain our particulate air quality standards, and they are also a direct health hazard.

These are very serious air quality problems. Long-range transport of pollutants undermines our efforts to keep the air clean and to protect the public health. It creates significant economic, institutional and equity difficulties for the Northeast.

I think you have heard many of those from the Attorneys General as to what the economic and equity issues are.

But the problem is that the sources are beyond our jurisdiction. Unfortunately, current Federal regulations and the Clean Air Act do not make it clear just exactly who does have the full jurisdiction.

Since it is a regional pollution problem, we look to EPA as an appropriate agency to resolve the issue, but EPA has failed to take appropriate action under the several sections of the act that they might be able to use.

They have further exacerbated the problem by their onconsistent handling of State air quality control plans for SO_2 and hydrocarbons in different EPA regions.

Just to highlight that, I have added as an appendix to my statement two charts: One chart that shows the relative emissions of sulfur dioxide, that shows at the very high level here.

This is Ohio, and it goes on down the line.

Basically what it says is that if you add up all the sulfur emissions from the six Northeastern States, New York and New Jersey, all combined, it would be less than Ohio alone.

The Midwestern States along the Ohio River Basin put out 3 to 4 times more than the New England States. It is not just that they put out a lot of it, because they have some very major utility sources. They put it out at a much higher rate.

The next table shows the major coal-fired plants in Ohio, West Virginia, Illinois, Indiana, and Pennsylvania, and the emission limits that apply. You have heard about inconsistencies in emission limits today. Here are the numbers: They range from 9 to 3.7

pounds of SO_2 per million Btu for those Midwestern States. The maximum number in any of our States is 4. The average of our six States is 2.1, 4 to 5 times less stringent emission limits than we have to apply to our coal-burning utilities, that is required by EPA in the Midwestern region. That deals with SO_2. There are similar inconsistencies in the ozone implementation.

For years, we have been writing to EPA, meeting with them, questioning their approach to ozone.

Where areas in the State don't have enough monitoring data, they are called unclassified and areas that have monitored data that show no violations of the ozone standard, they are attainment.

Those areas don't have to apply any pollution control, but we know that hydrocarbons from those areas of the States get mixed and arrive in New England as ozone.

In New England we have applied reasonable control over our entire States, whether they are attainment or unclassified or not.

EPA has refused to do that in other regions of the country, saying they would recommend it, but not require it. We have urged them to take the uncertainty out of these unclassified areas by forcing the States to step up their monitoring and classify those unclassified areas.

I have several years' worth of letters saying that that is likely to happen, but it hasn't happened yet.

All of this points to the EPA approach to deal with pollution and receptors in a very narrow focus, that as long as you are solving the local pollution problem by controlling local sources, then you are solving the problem. We are saying that that is not the way to handle long-range transport.

We urge Congress to amend the act to provide an absolutely clear mandate to EPA to deal with transported pollutants. Their Office of General Counsel is very adept at finding a shadow of a doubt to hide in when it comes to dealing with long-range transport.

We want to remove that doubt and make it clear that Congress intended for interstate pollution to be dealt with, just like they intended intrastate pollution to be dealt with.

We think the mandate should call for action to deal with all transported pollutants, not just the criteria pollutants, and the suggested framework is the one that has been repeated by many of of the Attorneys General here: Establishment of regional corridors; application of reasonable control strategies; and amendments that will allow flexibility to States in dealing with the problem.

I mentioned the Attorneys General because at a meeting in New York several months ago, it looked like we, the air pollution regulators, and they, the enforcers, were headed off in different directions.

I think Mr. Moore sensed that, too. Since then, we have really come together and are working very closely with each other so that we can input to the Attorneys General some good, sound regulatory approaches that they can submit to you to be considered in the act discussion.

As a final point, I just want to make a few comments about acid deposition and mention that the State air pollution and water pollution control directors have been working jointly on this problem.

In the material I have handed you is a damage report that we have made that cites the damages that we are seeing in New England. There is an economic assessment that we had the New England River Basin Commission do for us that showed at least a half billion dollar annual cost to the New England and New York region from materials, fisheries, and forest and crop damages, and that number may have been as high as several billion a year, if you consider the longer range effects. That doesn't include any health effects costs.

We think our damage report, our economic study, makes a clear case for some action. To supplement that, and I am not sure how to do this, but I would like to submit a slide show that we have prepared that highlights these damages that is very effective.

We have taken it to the Midwest and all around New England. Both groups seem to think it is a good show.

I would like to submit this and encourage staff, if they have a chance, to review it. It makes a very clear case of the damages we are seeing in New England.

Senator **Stafford**. We will accept that and we will have staff, and if possible some Members, review it.

Mr. **Fairchild**. I would appreciate it, not just because we had a hand in putting it together, but a variety of sources have seen it and think it makes a very clear statement of the issues involved.

In summary, I would like to mention one point in response to one issue that came up this morning. It highlights the problem. There was a chart presented by the Office of Technology Assessment that showed 55 percent of the acid deposition coming from outside New England, based on a certain model that was characterized as state of the art. We have some questions with that model. That model was based on information from Europe as to assumptions about how fast sulfur comes out of the atmosphere and changed into sulfate. It is biased as showing more fallout near the powerplant than farther away. Our studies show that that number should be something like 75 percent coming into New England. I speak to the gentleman from OTE; they said 75 percent seemed like a more reasonable number. I don't want to leave the committee with the impression that it is even a 50-50 deal. We are experiencing more transport than we are generating ourselves.

It all leads up to the final point, that this problem with the models and the data being thrown around, there are doubts about—there are concerns about exactly how much is coming from a particular plant to a particular receptor.

That should not be a reason for not taking some action. We feel the action is warranted, and we deal with that kind of uncertainty in the water pollution program. We don't require specific documentation of how much every upstream source contributed to every amount of pollution downstream. We apply a reasonable control upstream.

For transport air pollutants, we have to adopt the same kind of approach.

I want to encourage the committee to seriously consider these specific recommendations on acid rain and certainly to consider the broad issue of long-range transport in their deliberations.

Thank you for this opportunity to testify.

Senator **Stafford**. Thank you very much, Mr. Fairchild.

The next witness will be a member of our own general assembly, Mr. Maurice D. Arnold, better known, I think, as Red Arnold.

STATEMENT OF MAURICE D. ARNOLD

Mr. **Arnold**. Thank you very much, Mr. Chairman.

I appreciate this opportunity to address you.

For the record, I am Maurice D. Arnold, land management consultant from Whiting.

I am a member of the Vermont House of Representatives, and I am a member of the house Natural Resources Committee.

I should say at the outset that as an index of the interest that we have in your hearings, there are two other members of the general assembly here today.

Senator **Stafford**. Could you identify them for the record?

Mr. **Arnold**. There is Representative Millie Small, who is with the house Natural Resources Committee. She is there; and Representative Mark Condor. Mark was here and is probably around somewhere.

In any case, there are three members of the house Natural Resources Committee here from the general assembly.

My purpose is to draw to your attention a joint resolution, JRH-28, which is now addressed as R-58, of which I believe a copy has been sent to the committee as well.

This was adopted at the recently adjourned session of the 1983 general assembly. It recognizes the importance of clean air to Vermont's tourists, agriculture, and forestries; and calls on the State's delegation of Congress to play a lead role in improving the Clean Air Act during the current reauthorization process.

We are especially concerned about the long-range transport of pollutants, and particularly acid precipitation. We have heard a lot about that today. Regrettably, the evidence on acid precipitation is skimpy, but my own feeling is that this a real threat to the productivity of the land and water. It is very possible that we are at the periphery of a serious problem when the current methods of burning coal may result in vast sacrifice areas in the Northeastern United States and in Canada, and even elsewhere; and that we ought to try to prevent it, rather than directing afterwards, since that makes good sense from a strategic point of view.

Moreover, in this case, we had the problem that, as in the case of the fisheries, if we wait to collect the necessary hard evidence, we may wait too long. The hard evidence may come at a time when we get a serious and precipitous decline in productivity. I would point out that we already have a number of lakes in our State that do not have much threshold in buffering.

At the moment, we also can see some of our air pollution.

So we notice there is—and it is having an effect now, but the effect now is nothing compared to what I think it may be sometime in the future.

I cannot help but be sympathetic to the committee in the problem that it faces because I think that this is particularly a bad time for renewal of this act to come up.

We have, for example, the utilities throughout the Nation that are facing serious financial problems, and converting this external cost of long-range transport into an internal cost for utilities could well cause bankruptcy in many cases, particularly in the area where the causes may be, that is, in the Ohio Basin, and in nearby areas.

Second, I think that we have many businesses and large corporations who are under a real seige now from stockholders, because many of them have made some pretty bad strategic decisions in the past. These bad decisions are coming to live with them.

I think many of them are going to be concerned about the possible threat to continued profit, profitability, of having to take action.

But nevertheless, the need here is strong. I think we need to do something. I would point out that we do give heavy subsidies for fuel retrofiting and for nuclear purposes. Perhaps some of these could be used in a selective strategy to air at the bubbles where the causes are. In addition to that, we can be incremental in this case. We certainly need to have more study; there is no question about that, because we are just beginning to develop new information, as many witnesses point out.

In any case, the possibilities of injury here are great.

I think that the people who are injured, the States who are injured, the industries who are injured need to have some means of redress.

Perhaps that is another area of possible improvement in renewal of the act. Whatever, it is just a matter of common equity that no neighbor should do an injustice to another neighbor.

At the moment, we have problems with a neighbor and many neighbors. I expressed my wish to be of help in whatever way I can, and I wish you strength in vision and success.

I think you will need all of those.

Senator **Stafford**. Thank you very much.

My staff asked me to do something that lawyers, even ex-lawyers, seldom do. My recollection is that lawyers don't like to remember or even talk about cases they lost, but I have been reminded that last year I lost a vote in the Senate on the subject of acid rain, so let me ask you all one difficult question in which I have a parochial interest.

Last year I did ask the Senate to vote on eliminating sulfur dioxide emissions from electric generating plants that were proposed to turn from oil to coal by requiring scrubbers to avoid—not decrease, but to avoid increasing the loading of the atmosphere with sulfur dioxide.

I think most of the New England Senators were in agreement with me, particularly Mr. Tsongas of Massachusetts, and the others.

I lost with 32 votes. I should ask you, how do we succeed in getting those other 21 votes that I need to win?

I think the matter may puzzle you as much as me.

Mr. ARNOLD. That is not a rhetorical question. It certainly is a political question.

It would seem to me that there are large areas of the country that have a common interest with New England in this question.

It may be, in time, that if many of them realize that their industries, too, will be affected, that we are just first, that perhaps in time we shall have those 32.

There are at least three sectors of the country which could be a serious problem. I feel very diffident giving advice to a U.S. Senator on how to win votes from a U.S. Senator. Twice I sounded like a Canadian, but you, yourself, sir, referred to it this morning. I just want to stress here for everyone's benefit, the intense concern of the Canadians officially. It struck me how the Canadians, not the Environment Minister of the National Government, but the Foreign, External Affairs Minister gave a speech. When the equivalent of a Secretary of State of a nation gives a speech on such an issue, it takes an initiative. I was wondering if our counterpart would wonder if it is of major concern.

Senator STAFFORD. It is a matter of concern between the two countries. I have met at some length with the Canadian Minister on Environment and the Canadian Ambassador and the Canadian Minister on Public Works with the Canadian Ambassador on this same subject. I know of this concern. I think it may be a matter of education in the United States. I think I hail, therefore, the role that Governor Snelling has spearheaded with the eastern Canadian premiers and our Governors to study the aspects of this problem, which they have.

Mr. Fairchild?

Mr. FAIRCHILD. There is one other element of education that might help get across that problem. In that year, we have thought a lot more about how to reduce sulfur loadings, both in the Midwestern States and the Midwestern States have met informally on several occasions. I think we are seeing some much more flexible approaches in terms of regional emission limits, maybe having one plant go to natural gas, while several others continue to burn coal; a much more flexible approach.

So I think the requirement for strictly applying scrubbers everywhere is not as necessary now; and there is probably some more flexibility that if the Congressmen realize that, that they may not be tying their hands quite as tightly as they thought.

I think their technical people in their State agencies could speak to those things.

Senator STAFFORD. We have additional questions, yes.

In view of time constraints, and the endurance of our reporter, who is really doing the service work today, we will submit them to you in writing, if that is agreeable. Other members of the committee may wish to do the same thing. I hope you will be able to respond in reasonable time to those questions.

We thank you for helping us with a very difficult task.

Mr. WHITTAKER. Thank you.

Senator STAFFORD. We are now ready for the final panel for this afternoon. If the panelists can come forward to the witness table, Mr. Seward Weber, representing Vermont Coalition on Clean Air; Peg Bowers, representing the same organization; Mr. John Lindley, Associated Industries of Vermont; and Mr. Johannas Von Trapp, Von Trapp Family Lodge in Stowe, Vt.

Can the two of you from Vermont Coalition split 10 minutes? Do you each need 10 minutes?

Ms. BOWERS. We do.

Mr. WEBER. I do.

Senator STAFFORD. If you have gone to all the trouble to come here, we will give you 10 minutes.

Let's start with Mr. Weber and then take Ms. Bowers and then Mr. Lindley and then Mr. Von Trapp, if that is agreeable, and we will hold you to the 10 minutes.

STATEMENTS OF SEWARD WEBER, VERMONT NATURAL RESOURCES COUNCIL, REPRESENTATIVE, VERMONT COALITION ON CLEAN AIR, MONTPELIER, VT.; MARGARET BOWERS, REPRESENTATIVE, VERMONT COALITION ON CLEAN AIR, MONTPELIER, VT.; MR. JOHN M. LINDLEY, ASSOCIATED INDUSTRIES OF VERMONT, MONTPELIER, VT.; AND JOHANNAS VON TRAPP, VON TRAPP FAMILY LODGE, STOWE, VT.

Mr. WEBER. Thank you, Senator Stafford. In light of the fact that you are going to be strict with us and my testimony is a little long, I am going to skip the preliminaries and just say that I am Seward Weber, representing the Vermont Natural Resources Council and the Vermont Clean Air Coalition along with Vermont.

Senator STAFFORD. All of your testimony will appear in the record, Mr. Weber. I can assure you and all of the other witnesses that a professional staff member from each Senator on the committee will be reading everything that is said here today.

Mr. WEBER. Thank you. That is gratifying. I should like to limit my discussion today to a brief discussion.

No. 1, the environmental impacts of air pollution; No. 2, the effects of these on the economic and social welfare of the State and then enumerate some recommendations for changing the Clean Air Act.

The Vermont landscape and that of New England, as well as northeastern North America is under stress from years of manmade air pollution. It varies, of course, with location being more serious in industrialized southern New England, New York, and New Jersey, but northern New England and the eastern provinces of Canada are by no means immune to it.

Vermont has only relatively recently become fully aware of the long-range transport problem and the degree to which Vermonters are being victimized by it.

Attempts to obtain cheap energy or at least slow the growth of energy costs carry with them the danger of increasing air pollution by encouraging increased reliance on relatively abundant coal. But if, in your haste to ameliorate the immediate energy shortfall, we do not adequately account for the long-run dangers to the environment, we will have won a pyrrhic victory.

The landscape is a living system made up of innumerable subsystems depending on solar energy to perform an array of natural functions basic to the welfare of man and society. These include the usual multiple-use functions which give us so much pleasure and added meaning to our lives, while at the same time producing a variety of essential products such as wood and the ingredients of medicines.

But the landscape also plays a critical role in providing for our welfare by regulating the hydrologic, biogeochemical, and erosion cycles and moderating local climate. These cycles are all operated on solar energy and they are free but they don't happen in isolation of the landscape. They operate on and through the landscape and the atmosphere.

The ecosystems must carry on functions to sustain and enhance themselves in the face of destabilizing forces that could diminish or destroy them. The net result is a stability provided it is not upset by human activities. Of course, human intervention is intensifying with population growth and our craving for a high material standard of living. That is not necessarily bad. It just may in the long run be counterproductive.

In any event, man-induced pollution of air and water causes ecosystems to lose their capacity to maintain the stability of the landscape—that is, to moderate climate, filter air and water, recharge ground water, and to control erosion.

When natural systems which provide the conditions necessary for a productive, habitable, and enjoyable environment break down, the need arises to develop artificial means of accomplishing the same thing. It is my belief that even if we could artifically sustain in space-age fashion a chronically ill natural environment, we could never afford to do it.

Measurement of damage to the landscape is difficult because of the complexity of the natural systems and the fact that very little baseline data exists against which change can be gaged. Nevertheless, as Prof. F. H. Bormann of Yale University points out in a recently prepared paper:

> Large scale genetic, biological, and ecosystem changes are probably occurring under current levels of air pollution stress.
>
> Since the effects of air pollution on ecosystems are mostly indirect and cumulative, such as a reduction in the reproductive capacity of a key species or the progressive loss of fertility in forests or alkalinity of lakes, there is a legitimate concern that in a few decades, vulnerable forest, lake, and stream ecosystems may simply fall apart.

Bormann describes in his paper three levels or stages of pollution stress that can lead to ecosystem collapse. Stage I is minor and does not produce species or ecosystem malfunctioning. In the more advanced condition of stage II some plant species will die out for the most part, usually succumbing to some secondary cause such as fungal or insect attack.

There are repercussions, of course, all through the system. In stage III with increased pollution stress trees and other large plants die off and the structure of the forest ecosystem changes dramatically. Productivity is greatly reduced and the ability of the ecosystem to regulate biogeochemical cycles is diminished. The final throes of stage III is ecosystem collapse from which recovery can be a very long-term affair.

Bormann believes that there is evidence that some parts of New England are in stage I while, and I quote here again, "considerable area is probably well advanced into stages IIA and IIB . . ." He says that stage III conditions are rare in the Northeast but that they can be seen in localized situations adjacent to smelters in Canada, Connecticut, and Pennsylvania.

Professor Bormann is not claiming that the sky is falling but he is saying, and supporting it with research findings on sensitive species, the potential effects of acid rain, growth response of some tree populations and productivity responses to air pollution, that current levels of air pollution have the potential to seriously damage the landscape of the Northeastern United States and adjacent Canada.

Moving on to a discussion of the relationship of all this to our economy, I would like to say that Vermont, more than industrialized States, has a close linkage between its principal economic sectors and its environment. Agriculture, forest products, tourism and recreation, quarrying, and even manufacturing, to the extent that manufacturing plants are located here because of quality-of-life factors, are directly dependent on the ambience of the landscape.

If our landscape suffers, so do our people, not only through the direct health effects of air pollution but indirectly through loss of jobs and livelihood. If acid deposition, for example, decimates our sport fishing industry, the loss to the State's economy will be up to $75 million—according to Alphonse Gilbert, resource economic department, University of Vermont.

If in time the Green Mountains lose much of their vegetative cover, not only will our wood products industry be deprived of a substantial source of raw material but the State's ability to attract tourists would be substantially affected.

These possibilities are not outlandish. If they occur, it will not be because Vermonters are fouling their own nest. It will happen because we have been victimized by the long-range transport of air pollutants from upwind.

Vermont's future lies down the road not taken by most of our neighboring States to the south. Our natural heritage, geographic location, and the accidents of history have placed us apart from the industrialized Northeast and we cannot, nor should we aspire to, become a New Jersey, eastern Massachusetts, or even southern New Hampshire.

Our future lies with the cultivation and improvement of our rural landscape and the economic activities which have historically drawn sustenance from it. Our environment provides the raw material for those activities. The air is part of that raw material base and if it is not kept clean it may become the agent of our economic and social destruction.

I would like to conclude with a few specific recommendations concerning the Clean Air Act. The Vermont Clean Air Coalition and the Vermont Natural Resources Council believe that the Clean Air Act should be strengthened. As I have tried to point out, the danger to the environment of continued air pollution stress at the present level of intensity is viewed by environmental scientists as significant if present conditions are allowed to persist or become aggravated.

While it is not a question of hillsides turning brown tomorrow or next year, the Northeast could face extraordinary environmental problems two or three decades from now at which time it would be difficult if not impossible to react effectively.

We believe that attempts to weaken the act are misguided and should be resisted. The act should: Retain prevention of significant deterioration provisions; retain automobile emission standards and deadlines; retain the current method of establishing national ambient air quality standards to protect sensitive populations with a margin of safety and without the application of cost-benefit considerations; retain deadlines for attaining ambient air quality standards; retain offset requirements and lowest achievable emission rates for the new sources in nonattainment areas; retain the current no-credit-for-tall-stacks policy. Finally, the following improvements should be made to the act: Reduce sulfur dioxide and nitrogen oxides emissions from poorly controlled existing stationary sources to bring acid deposition under control; repeal the special exemption for the smelter industry; mandate energy conservation practices so as to reduce the need for increased electrical generating capacity and consumption of fossil fuels for space heating; add fine particulate matter to the list of criteria pollutants and establish standards for it that are more stringent than those of total suspended particulates; place a moratorium on relaxations of State implementation plans granted by EPA; and create a workable mechanism by which States adversely affected by poorly controlled upwind sources can seek relief.

We believe that these are necessary in order to reduce air pollution induced stress on the natural environment of New England and Vermont.

The prudent course is one of prevention and stewardship, not one of crisis intervention 10 or 20 years from now when it may be too late to reverse ecosystem deterioration or collapse.

Thank you very much.

Senator **Stafford**. Thank you very much, Mr. Weber.

The next witness will be another representative from Vermont Coalition on Clean Air, Peg Bowers.

STATEMENT OF MARGARET BOWERS

Ms. **Bowers**. My name is Margaret Bowers, volunteer coordinator of clean air activities for the Vermont Lung Association, which is a member of the Vermont Clean Air Coalition.

We wish to thank you, Senator Stafford, for calling this hearing and giving us an opportunity to present testimony on the interstate transport of air pollution to Vermont. We are here today to speak on behalf of not only our 55,000 supporters but of the half million citizens of the Green Mountains State whose health and lives depend on the purity of the air we breathe. We speak not as a special interest group, for the quality of air cannot be considered a special interest. Indeed, it cannot be considered apart from the quality of life itself.

We, in Vermont, are proud of our representation for exceptionally clean air and our pristine environment. A Vermonter once claimed the air here is so pure as to have been "barely breathed twice." While that may be a slight overstatement, it is true that our air historically has been among the purest in the Nation and our commitment to it the strongest.

Our State air quality program began in 1968 when our first air pollution control law was enacted. Since then our consistent commitment and hard work aided in 1970 by the mandates of the Clean Air Act, have brought nearly all major stationary air pollution laws in compliance with emission control standards.

Industrial pollution controls have been installed; dirty fuels replaced with cleaner burning ones and open burning banned. Clearly, we have demonstrated our determination to maintain a healthful environment. It is no accident that our air is among the cleanest in the Nation.

Of great concern to us, now, however, are the poisons carried here in the atmosphere from industry States south and west to us, poisons that threaten not only our way of life but life itself. We all have heard the great outcry evoked by the visible effects of acid rain on our lakes, fish, and vegetation.

Now we must focus on the silent and visible threat on those same sulfates to visible health, our health and that of our children and our neighbors.

When sulfates in the atmosphere are not being dissolved in rain or snow and falling to the earth as sulfur rich acid, they are falling through the air as fine respirable particles. Sulfate particles are extremely tiny: one-tenth to one micron. As such, they can bypass the upper repiratory tract, which traps large types of airborne particles.

The sulfate particles travel deep into the lungs where they can become trapped and aggravate the symptoms of respiratory disease, increase acute lower respiratory distress, and affect the respiratory function of children.

There is no national standard to control this fall of sulfate particles. Fine particles elude control by the total suspended particulate standard because that standard is based on weight, but sulfate particles are extremely toxic, 10 to 100 times more so than the equivalent amount of sulfur dioxide.

Sulfate concentrations in Vermont constitute 50 percent of our fine particulate pollution on the average and at times they reach 75 percent, yet Vermont has the lowest sulfur dioxide emissions of any State east of the Mississippi.

According to the Vermont Agency of Environmental Conservation, 73 percent of total suspended particulate pollution in Vermont, and 45 percent of fine respirable particles, travel here from smokestacks of other States.

Since 1970, the EPA, working under the Clean Air Act, has tried to reduce sulfur dioxide emissions by making users of pine sulfur install controls. One so-called control method used by many large polluters was taller smokestacks.

By the time sulfur dioxide released from those stacks reaches the Northeast and has undergone complex chemical changes and is transferred to the more toxic sulfate particles or to acid rain.

The Vermont Lung Association opposes the use of tall stacks as a primary method to obtain air quality standards in any region.

Further, we are calling on Congress to assign a high priority to the sister problems of acid rain and the fall of sulfate particles when considering strategies for dealing with the interstate transport of air pollution.

The VLA believes there is an important need for the development of national ambient air quality standards for fine particles. The EPA should rapidly expand the research program and health effects of fine particles to support the standard-setting process.

In setting those standards and in reauthorizing the act to maintain those already set, we urge the Congress to retain the health basis for primary standards and to vigorously reject all attempts to introduce consideration of the cost of control into the standard-setting process. There is no rationale alternative for these reasons: a true cost-benefit analysis would have to compare the benefits of a healthier, more vigorous population having less absenteeism from work or school and fewer health care expenses to a society in which some people are allowed to suffering breathing impairment, chronic illnesses and even to enhance the profit of an industry or absolutely lower the cost of a product to consumers.

A true cost-benefit analysis must hang a price tag on a pregnant woman's ability to give birth to a healthy child and a 2-year-old's chances of growing into a healthy man or the ability of a 50-year-old worker with asthma to keep working.

A true cost-benefit analysis would, in fact, require a price to be set on human life. Unless Congress is willing to set such a price, that analysis is impossible.

The Vermont Lung Association urges Congress to consider cost to business and industry in the development and control strategies and in the streamlining, wherever possible, the process for meeting standards, but not in the setting of standards.

The burden of paying for the disposal of wastes from industry cannot be removed by legislation. It can only be shifted—either industry will pay for the clean disposal of its own wastes, making that expense a fair part of its price to consumers, or citizens will unvoluntarily pay for pollution with their health, their health care dollars, and some will pay with their lives.

The burden then will fall most heavily on those least able to control it, unborn and very young children, the elderly, and the commonly ill.

Air pollution is a factor in the development of our three major killers, in Vermont, as well as nationwide: Heart disease, cancer and lung disease. Lung disease alone kills more than three times as many Vermonters each year as all motor vehicle accidents.

In addition, more than half of our infant deaths are related to respiratory disorders. Unlike most other health risks in our society, air pollution offers no choice. We must breathe the air.

The only way we can manage this risk is through our Government. We are thankful for a Government which has traditionally placed the right of the people to health and safety above the desire of anyone for financial gain.

In addition to requiring air quality standards for certain pollutants, the Clean Air Act authorizes EPA to set emissions limits on hazardous air pollutants for which there is no standards, but which would allow poor health or injuries—of the hundreds of hazardous substances emitted into the air, the EPA so far has issued standards before.

The Vermont Lung Association believes the Clean Air Act should speed EPA's setting of emission limits and issuances of standards.

Finally, standards are useless without meaningful deadlines and penalties. Therefore, the Vermont Lung Association supports the retention of deadlines, for retaining the national ambient air quality standards now contained in the Clean Air Act.

We further support strengthening the EPA's enforcement authority and authorizing disincentives such as compliance penalties, excess emissions charges, and economic sanctions.

The Clean Air Act already has saved many lives. It must continue to be strong and to meet the new challenges of the eighties. The Vermont Lung Association believes the protection of public health is a basic responsibility of Government. We are calling upon our elected representatives in Congress to meet that responsibility with strength and honor.

Thank you.

Senator STAFFORD. Thank you very much.

The next witness will be Mr. John Lindley of the Associated Industries of Vermont.

STATEMENT OF JOHN LINDLEY

Mr. LINDLEY. Mr. Chairman, staff members of the Senate Committee on Environment and Public Works, my name is John M. Lindley, Jr. I am executive vice president of the Associated Industries of Vermont. I reside in Montpelier. The Associated Industries of Vermont is an association of Vermont businesses numbering approximately 350.

The businesses that are members vary widely, not only in size but in business with manufacturers representing the majority of our membership.

Although there is a wide diversity in our membership, the employees of the companies who include not only the so-called laboring group, but also the management employees, have a common interest in maintaining the traditionally superior environmental climate of Vermont.

We all live here and have no interest in fouling our nest. Of course, there is the obvious balance on the other side of the scale which must be considered. Employment opportunities for our citizens are required so that they can, in fact, live in Vermont without being public charges.

The concept of environmental purity which requires no compromise with environmental standards and rules usually reflects a totally unacceptable rigidity which, in turn, usually leads to less than a cooperative attitude among those most interested in the stakes: The citizens who are affected by the decisions of the regulators.

In the invitation which I received to testify before this committee, there were a number of subjects involved in air pollution which, quite frankly, I am totally unqualified to discuss. However, recognizing that limited knowledge in this field, there are a few points that should be made in the name of Vermont business.

First, and perhaps most important, is the ability that the Vermont business community has had to work with the Vermont Environmental Conservation Agency in the implementation of the air pollution program in Vermont.

As I have said before, the people with the most at stake in this effort are the citizens of Vermont, and it has been my experience that they have been well served by this ability to work on a friendly, cooperative basis with the State regulators rather than on a raised-fist basis.

The business community has cooperated fully with the State regulators and spent money lavishly in its effort to do so. The State regulators, on the other hand, have tried to be helpful rather than overbearing and officious.

The result of this cooperative effort in Vermont, I think, is quite evident as you visit throughout the State. Any substantive change in the Clean Air Act which would require Federal control through the EPA would be a distinct disservice to Vermont.

A second subject which has been covered professionally by others but one which deserves comment from lay people, as well as the professional: the subject of air transport. It has been well publicized that pollution created to the west of Vermont and in no way related to our own activities, nonetheless controls to a very substantial extent what Vermonters are able to put into the atmosphere as a result of our business activities.

It goes without saying that Vermonters are reluctant to have their environment controlled by others who lack any personal concern with the well-being of Vermonters.

The current buzz words heard on a daily basis are acid rain. Let me point out that over the last few years we have had many catchy buzz words which, after a period of frightening the general populace, have faded away with proper research and exploration.

The sky was falling because of the use of freon for underarm deodorant sprays. Low-calorie drinks would subject people to cancer exposure because of the saccharin. Mercury levels in fish, which certainly spell cancer again; red dye in foods was another carcinogen, as was the dye used in higher sprays. The chemicals added to cranberries and the preservatives in bacon certainly were deadly.

One further note on how these popular concerns have a way of proving to be less critical than their initial impact would indicate is the book "One Hundred Million Guinea Pigs," that was published in 1933, concerning the perils of that age because of the chemicals generally in use.

I would bring to your attention that the "One Hundred Million Guinea Pigs" referred to the population of the United States of that time. Since then the human race has managed to increase in numbers to some extent in spite of the hazards outlined in this book of almost 50 years ago. There is no question that the air pollution created to the west of Vermont in the industrial heartland of the United States follows the West to East weather patterns.

We must be concerned with that, but we must also recognize that very few of us in Vermont, or for that matter, any other part of the United States, would have our present standard of living without the industry which is represented in that industrial heartland of the United States.

The next question that must be answered is: How much can we, the citizens not only of Vermont but of the United States, afford to pay for the products coming from the industrial heartland so that, in fact, those companies can remove the air pollution which they are currently creating?

That is not an easy question to answer, and your decisions regarding the Clean Air Act will require the wisdom of Solomon. On behalf of the business community of the State of Vermont, I do wish you well in your efforts and hope that the current realistic confrontation techniques of solving our environment problems can be moderated, at least to some extent. The cooperative approach which we have experienced here in Vermont with the Environmental Conservation Agency seems to have served the environmental cause better.

Thank you for this opportunity of testifying before this committee.

Senator STAFFORD. Thank you very much, Mr. Lindley.

The final witness in this panel will be Mr. Johannas Von Trapp.

STATEMENT OF JOHANNAS VON TRAPP

Mr. VON TRAPP. Thank you, Senator Stafford.

My name is Johannas Von Trapp. My education includes a master's degree in forestry from Yale University. I am a member and past chairman of the Vermont Board of Forests, Parks and Recreation.

I am a trustee of the Stowe Area Association. I have traveled extensively throughout the world and lived in several foreign countries before returning to Vermont to run the family business, the Trapp family lodge in Stowe.

Above all, I am a resident of the State of Vermont and a human being, and I am beginning to get angry.

My family fled our home in Austria during World War II in the face of a brutally offensive Nazi regime. We were attracted to a country where it was believed that rights to life, liberty and the pursuit of happiness were held to be truths self-evident, and I am beginning to have my doubts. I am beginning to wonder how much longer Vermonters will be forced to pay the bill for air pollution emitted beyond our boundaries.

How much longer must we subsidize electric rates in such wealthy States as Ohio, Illinois and Pennsylvania by sacrificing our environment, our economy, our health and our lives. As a businessman in the tourist business, I am particularly concerned about the effects of transported sulfates on visibility.

It is no secret that people come to my lodge for the scenery. We are located high on a ridge overlooking the Stowe Valley. On a clear day, the views are absolutely breathtaking. Unfortunately, those clear days are becoming scarcer and scarcer.

We have noticed what seemed an increase in hazy days, especially in the summer, for several years now, and recently I have learned that my suspicions were justified. Visibility has been deteriorating in New England over the past several decades and the summer, which used to be our clearest season, is now our worst.

I have learned that sulfate particles in our air are the prime culprits in this visibility problem, and that there is nothing we in Vermont can do about it.

As a forester, I manage large tracts of woodland and I am extremely concerned about the potential effects of acid precipitation and heavy metal deposition on forest productivity. Here in New England, where our growing season is short, forestry management is a marginal investment at best.

A 6-percent investment with a 40-year return is not about to bankrupt the money market funds. Anything which reduces forest growth by the slightest amount may very well mean the end of the forestry in Vermont.

I am alarmed to learn that rainfall with a pH of 3.22 has been recorded on top of Mount Mansfield; that the pH at some of our high elevation forest soils is less than 3.5; that concentrations of such toxic heavy metals as lead, copper and zinc in some of these high elevation soils have nearly doubled over the past 15 years, and that the humic layer in these areas is not breaking down and recycling the vital nutrients, but is getting deeper year by year.

We are seeing dramatic declines in red spruce, maple and beech populations at elevations above 2,500 feet. Granted, these high elevation ecosystems are more fragile than their lower elevation counterparts, but this is no reason to destroy them forever. If these fragile areas are our canaries, it is high time we got out of the mine.

These effects on our tourist and forestry economy are real, serious, and particularly unfair burdens to impose on a State which constricts practically nothing to the problem. But my greatest concern by far is the health effects associated with sulfate and other transported fine particulates.

The health evidence on sulfate is absolutely overwhelming and we have been aware of it for years. How many more hundreds of thousands of innocent people will die unnecessarily before we have a sulfate or fine particulate standard and take strong measures to achieve that standard?

Is it really such a difficult decision to balance a 1- or 2-percent increase in electric rates with the health of countless individuals with asthma, bronchitis, emphysema and other respiratory ailments?

We know that many of these diseases are aggravated by sulfate concentration many times lower than we experience in Vermont after winds from Ohio.

There is pressure from certain interest groups to further relax the existing health standards, to change the basis of these standards from protection of sensitive individuals to protection of the average healthy one.

After all, many of these sensitive individuals are very old, and what difference does a few years make one way or the other? Besides, they are in the minority and this is the land of majority rule. What I would like to know is, once we have succeeded in exterminating this minority group in the name of the economy, who will be next? The parallels between this situation and the one my family fled in Austria are only too clear.

The polls have demonstrated over and over again that the American people want above all to live a quality life. We do not work for money just to have money. We work to have the quality of life which the money can provide. Decisions made to strengthen the economy which detract from the quality of life are not beneficial to anyone.

This is particularly true in Vermont where the quality of our environment is the prime reason most of us live here. Why else would we put up with 8 months of winter.

We certainly don't live here because of the booming economy. Our environmental laws are strict, but no amount of additional controls on our local industry will have the slightest effect on our sulfate and ozone problems.

Shifting of authority from the Federal to State level is fine for some things. But when one State is affected by pollution from another State, the Federal Government is the only place we can turn for relief.

I am sure you are all familiar with Garret Hardin's "Piece the Tragedy of the Commons." Briefly, he uses the example of the colonial New England town commons to demonstrate the disadvantage of common ownership. Everyone is free to graze their livestock on the common land and soon, there is no grass left.

A scarce resource under common ownership which can be consumed at no cost to the consumer will quickly disappear. The current administration rode a campaign based on similar principles to a landslide victory last November.

The American people were fed up with collective ownership, big government and big taxes, but let us hope that the shift is not from big government to big industry, and let us not forget that our country was founded on the premise that the rights of the individual to the life, liberty and the pursuit of a quality life were held sacred above all else.

Whether we like it or not, our air is the commons, and unless we all plan to carry around our own oxygen supplies, there is no way around this common ownership. The air over Ohio does not stay over Ohio. It moves, and all too often, it moves over Vermont. We can't blame it, either.

The inevitability of this common ownership is not addressed adequately in the present form of the Clean Air Act. The problem of long range transport must be addressed in the upcoming rewrite of the act, and the decisions must be made on the basis of protecting human life.

This is, or at least should be, the primary responsibility of government. Clean air is a scarce resource, and if we continue to let certain interest groups dump their garbage into it, we will soon run out of it.

I fully realize that Vermonters are a minority group. We cannot offer the electoral votes of an Ohio or an Illinois or a Pennsylvania, and we cannot compete in Washington with the powerful utility and industry lobbyists, but those of you in other States must ask yourself this question: If you allow Vermont's streams, lakes, air and the lives of our people to be ruined because we are a small minority, which of your States will be the next to go?

I would like some day to be able to take my grandson on a hike through the woods and show him all the countless species of plants and animals that live there now. I would like to take him to the top of Mount Mansfield and show him the view of Mount Washington on one of those perfect crystal-clear days.

I would like to take him down to the brook and watch him catch his first trout. I would like him to have a long and healthy life and to be able to do these same things with his grandchildren.

Is this so much to ask?

Senator STAFFORD. Thank you very much, Mr. Von Trapp.

I would like for the committee and its members to reserve the right of all members to submit questions to this panel also in writing if that is agreeable, for responses in writing at your early convenience so we will have the benefit of that wisdom as we get into markup.

Let me ask you just one question now, though, if any of you care to respond to it. That is this: If each of you could make a cycle change in the Clean Air Act, what would that be? If you would like to think about it, you can answer it in writing.

Mr. WEBER. I think that would bear some thought. I would like to answer it in writing.

Senator STAFFORD. I think I wouldn't care to answer it offhand, myself.

At this point, the Chair, for the committee, is very grateful to everybody who has been here and testified and those who have been panelists. We have received for inclusion in the record and without objection, we are going to place in the record a letter and copies of a resolution from the Federated Garden Clubs of Vermont, supporting continuation of a strong Clean Air Act.

The Federated Garden Club has 1,300 members and 19 active clubs throughout this State.

We have also received a resolution from the Garden Club of America, urging reauthorization of the Clean Air Act, and stating that the club considers "clean air to be of vital importance to the health, horticulture, environment and climate of this Nation and the world."

The Garden Club of America represents over 10,000 members throughout the Nation.

So we will include those letters in the record, and also a statement of Carol Wagner of Underhill Center, Vt., relating to her personal experience to health of effects of air pollution.

[The letters referred to follow:]

Federated Garden Clubs of Vermont

Mrs. Calvin P. Otto, President
124 Elm Street
Bennington, Vermont 05201
(802) 442-9601

June 30, 1981

Senator Robert T. Stafford
Room 5219
Dirkson Senate Office Bldg.
Washington, D.C 20510

Dear Senator Stafford:

As President of this organization I would like to express the concern of the 1300 members in nineteen active clubs throughout the state in regard to the possibilities of lowering the standards of air quality through passage of a less stringent Clean Air Act.

This Federation took a formal position against the pollution of air, soil and water through resolutions passed in 1969, and has reaffirmed that position periodically since that time. I am enclosing a copy of the pertinent resolutions, and wish to particularly point out the one stating: "We favor strong laws to protect Vermont land, water and air from radioactive, thermal, pesticide and other pollutants".

Recent information on the threat to Vermont and other states in New England from acidic rainfall increases our concern for the need for strong legislation from the Federal government.

An open meeting sponsored by the Bennington Garden Club as an informational forum concerning acid rain in Vermont has alerted us to the proof of higher acidity in surface water in Vermont, especially in the higher elevations where the buffering capacity is low. Much of our water supply comes from these areas. We wonder what effect this will have on water quality as well as air quality from pollutants beyond our local control. I am enclosing a copy of the press report on the meeting which gives some facts to be noted; i.e. that rain falling in Bennington County averages ten to forty times more acid than normal.

It is the hope of this Federation that you will make every effort to keep tight controls on air quality when restructuring the Clean Air Act.

Sincerely yours,

Mrs. Calvin P. Otto

Mrs. Calvin P. Otto, President
Federated Garden Clubs of Vermont

Enc. ; 2

THE GARDEN CLUB OF AMERICA
598 MADISON AVENUE, NEW YORK, N. Y. 10022
TELEPHONE PLAZA 3-6287

PRESIDENT
MRS. R. HENRY NORWEB

NATIONAL AFFAIRS AND LEGISLATION COMMITTEE
CHAIRMAN
MRS. W. BOULTON KELLY, JR.
7214 BELLONA AVE.
BALTIMORE, MD 21212

RESOLUTION:

THE GARDEN CLUB OF AMERICA SUPPORTS THE REAUTHORIZATION OF THE CLEAN AIR ACT. WHILE RECOGNIZING THAT THE COMPLEX STANDARDS AND REGULATIONS ESTABLISHED BY THE CLEAN AIR ACT AMENDMENTS OF 1970 AND 1977 OFTEN ARE CONTROVERSIAL AND BURDENSOME, THE GARDEN CLUB OF AMERICA CONSIDERS CLEAN AIR TO BE OF VITAL IMPORTANCE TO THE HEALTH, HORTICULTURE, ENVIRONMENT AND CLIMATE OF THIS NATION AND THE WORLD.

The Garden Club of America consists of over 182 clubs in almost every state of the Union, - and represents over 10,000 members

Thank you for this opportunity to present our resolution.

Sincerely -
Elizabeth C. Titus
Conservation Chairman - Zone 1
Garden Club of America

Maratuck Farm
Shaftsbury, Vt. 05262

Carol C. Wagner
P.O. Box 153
Underhill Center, VT 05490

STATEMENT TO THE SENATE COMMITTEE HEARING ON AIR POLLUTION, HELD IN RANDOLPH, VT, JUNE 30, 1981

My name is Carol Wagner. I reside in Underhill Center, Vermont. I am 44 years old.

I suffer from an environmental illness, namely, hypersensitivity to ambient air pollutants.

As an intelligent and informed layperson, with much at stake in the control of air pollutants, I offer the following observations.

A. My Experience of Air Pollution in Vermont

Four years ago, in the hope of escaping air pollution and thereby halting, or even reversing, upper respiratory symptoms and lung damage that were clearly linked to the effects of ambient pollutants, I moved from New Jersey to Vermont.

In the sequel, however, I discovered that ambient pollutants were no respecters of state boundaries or of regions. To my dismay, I found that air pollutants carried into Vermont from elsewhere by winds or the movement of weather systems continued to erode my health. Even though I now live in the country, surrounded by thousands of acres of woods, the lung damage and other pollution-related illness I suffer on an ongoing basis has led to a significant deterioration of my health from ~~from~~ its pre-Vermont level.

1) Invariably, several days of southerly winds shroud the Green Mountains in the same same clinging, white, chemical-laden smog that characterizes the New Jersey landscape -- ~~and~~ which is undoubtedly one of its points of origin. This smog is the product of incomplete burning of petrochemical products (primarily automotive gasoline); these may go through various toxic chemical transformations, particularly the action of sunlight, which may convert these gases to ozone, a known respiratory irritant with probable links to other kinds of physiological dysfunction.

This smog, when combined with a high particulate count, can reach an optical density so great that it is often impossible to see west across Lake Champlain to the

Adirondacks, or, from Burlington, to make out Mount Mansfield, 20 miles to the northeast.

2) We also experience in Vermont episodes of visible, high concentrations of suspended particulates (i.e., dirt, soot, grit, and other airborne particles). These seem to occur: (a) whenever a "Bermuda High" causes weather stagnation along the East Coast; (b) whenever a high pressure weather system becomes stationary over the northeast for several days; (c) whenever a temperature inversion traps pollutants and prevents their ventilation into the ~~higher~~ upper atmosphere. Occurrence of any of these conditions in the winter, when thousands upon thousands of home chimneys are spewing wood smoke or coal soot into the air can present a significant hazard to anyone with limited lung function. In the case of inversions, the optical difference between the dark grey, dirt-laden lower level of air and the clarity of the upper, colder layer of air can be so definite that not only is the border between the two visible to the eye, but is can also be vividly recorded on ordinary color-positive photographic film.

3) There are also within the state of Vermont certain locations where local vehicular activity produces unacceptably high levels of carbon monoxide and other toxic products of auto exhaust. Certainly, anyone who has driven through the "Five Corners" in Essex Junction at rush hour on a windless day will be familiar with the dizziness (and, in some cases, headache) that exposure to auto fumes there can produce, even in non-sensitive individuals.

4) Historic problems of certain industries in Vermont, such as stone-cutting and asbestos production, are subjects with which I have had (as far as I am aware) no personal contact.

B. Personal Health Effects of Various Pollutants

1) Smog. The appearance of smog, which is often coupled with windlessness and high humidity, afflicts me initially with undue fatigue, with some mental confusion, and an "out-of-sorts" feeling. As the period of smog continues, my fatigue intensifies, I begin to experience a burning sensation in the lining of my nose, sinuses, throat, bronchi, and lungs, and I feel breathless and headachy. By the third day of a smog episode, all these symptoms become acute; I am so exhausted that I must stay in bed; my upper respiratory mucous membranes, my lips, and my eyes feel as though acid had been poured on them; I develop nausea and a migraine headache that is so excruciatingly painful that even codeine fails to block the pain. Once this state of

affairs is reached, it continues for the duration of the smog episode (which can be a week or more).

When a new weather system (usually a high pressure system moving in from the west or northwest) finally clears the smog and supplants it with unpolluted air, it takes my body at least a day to recover from the headache(s), and several more days of burning sensations in my upper respiratory tract and lungs before my breathing ceases to be painful and unduly restricted, and returns to what, for me, is "normal" functioning.

During the summer of 1980, episodes as I have just described occurred about every two weeks; in the winter of 1980-81, about every four to six weeks.

2) Suspended Particulates. Particulates, unless toxic substances have been adsorbed onto them, do not usually have the toxic effect of my health that smog does. However, since my lungs have evidently lost their ability to cleanse themselves of intrusive particles, exposure of more than one day or so to high particulate levels begins to restrict my ability to absorb oxygen. I become breathless upon the least exertion (walking and climbing stairs become virtually impossible); the resultant anoxia leaves me too tired to do more than sit or lie down and read or watch TV. Continued exposure also results in congestion of the blood supply around my eyes, and to severe sinus headache.

C. Personal Conclusions Regarding Air Pollution in Vermont

1) The most significant Vermont air pollution originates out-of-state.

2) Air pollution episodes here are more frequent, more intense, and more damaging to the health of Vermonters than the State is willing to admit.

3) A comprehensive program should be established to properly monitor the Vermont air pollution problem and its effects. Parameters should include (a) analyzing statewide patterns, levels, and frequencies of various pollutants and (b) correlating the results of that analysis with population morbidity from air pollution.

4) Under no condition should the provisions of the Clean Air Act of 1970 be lessened or relaxed. Should this happen, migration of out-of-state air pollutants into Vermont will inevitably increase, and our existing air pollution problem -- already (in my opinion) serious -- could become infinitely worse.

Carol C. Wag

Carol C. Wagner

Senator **Stafford**. Now, unless there is further business at this time, the committee is going into recess until 7:30 p.m., when we will be hearing from individual members who may wish to speak.

I will have to repeat that we will encourage people who do speak to limit their remarks to 2 or 3 minutes, but we will allow up to, but not beyond 5 minutes.

If necessary, those of you who wish to come back, we would be very happy to see you at 7:30 p.m..

I thank you all.

[Whereupon, at 5:15 p.m., the committee recessed, to reconvene at 7:30 p.m., Tuesday, June 30, 1981.]

EVENING SESSION

Senator **Stafford**. I would ask the Committee on Environment and Public Works to come to order.

This is a continuation of the hearing on Clean Air matters that began at 12 o'clock today. We completed the panels this afternoon at about 5:30. We are now going to individuals who may wish to speak.

At the conclusion of those individuals who wish to speak, we will hear any organizations who have a spokesman here. In view of the numbers who have signed up, the Chair is going to be very tough about time, and we would ask you to complete your remarks in not over 3 minutes.

We will gavel you down in 5 minutes, so 5 minutes will be the maximum. We are going to invite those who signed up before today to speak first in the order in which they signed up. Then those who have signed up today will follow in the order in which they signed up.

The Chair will name the person who is to come to the mike, and the second person. Each time we will try to warn you one in advance who will be the next speaker so that whoever is following a speaker who is actually making a presentation will be ready to go quickly when they are called on.

The first person to be recognized by the committee is Syl Stempel. I apologize if I mispronounce people's names.

Syl Stempel will be followed by Dr. Philip Marshall of Burlington, Vt. Syl, we recognize you, and we are going to time you.

STATEMENT OF SYL STEMPEL, REPRESENTING THE VERMONT COUNCIL OF TROUT UNLIMITED CENTER

Mr. **Stempel**. I will try and keep my remarks short.

I am representing the Vermont Council of Trout Unlimited Center. Our national representative has already testified in front of the full committee. So I will direct my remarks to Vermont.

I am not an expert in acid rain, however, I read a lot, and one of the things that frightens me or worries me is the fact that the current state of the economy, and a lot of things that I have read, is that utilities industries in the Midwest are using the point of, "We cannot afford to put in scrubbers and wash coal," et cetera, "because it simply costs too much."

Yet nobody has brought out the point, the fact that acid rain has the potential to destroy, in monetary amounts, vast resources here in the State.

In 1980, the sport fishing industry in Vermont was projected to be a $75 million business. This is everybody from the local kid who sells night crawlers on the corner for 25 cents, to August, which is a multibillion dollar organization. These figures are not something that have been pulled out of the hat, but it is research that has been done by the University of Vermont Secondary Research Department.

We have invested a tremendous amount of public money in the form of taxation to clean up our State's waterways. I believe the figure is over a $100 million.

The question that I can point to the committee is, why did we invest all this public money if we are going to turn around and allow the Clean Air Act to be modified so that somebody in Ohio can, basically, dump their garbage on whoever they want? It is not fair.

We look forward to you, to your committee, for guidance because that is the only way it can be done. Testimony was brought out today that it has to be the Federal section that has to ride herd over all the States.

We have invested a tremendous amount of money in the Connecticut River line restoration project, public, private money. Returns are being seen. It is working. We have the largest most modern land salmon hatchery in the world.

I haven't traveled around the world, but that is what I have been told, on our own shores of our White River in our State. What frightens me is the West River, a river that flows in Connecticut, has already been proven that because of the acidity, there is no natural reproduction in that river.

The hatchery at Bethel draws its supply directly from the White River. If that river goes, a whole million dollar hatchery is just shot. Why did we build it? Why did we do all these things? We can't go backwards. We have to go forward and we have to strengthen the act.

I am going to quote Hon. George Akem in the "Award of Man for All Seasons," he writes that one of his treasured boyhood remembrances is counting the days off the calendar to the opening day of the trout season.

As a youngster, I also have shared that experience of "it is going on today." The question that is facing us is, are future generations of Vermont children going to be able to do the same thing?

Thank you.

Senator STAFFORD. Thank you very much, Mr. Stempel.

Now we recognize Dr. Philip Marshall, if he is here. Dr. Philip Marshall will be followed by Dr. Ernest Marshall.

Mr. E. MARSHALL. I am Ernest.

Senator STAFFORD. We will recognize you since we don't see Cohen. Is there a relationship between the two?

Mr. E. MARSHALL. I haven't seen the man. I don't know.

Senator STAFFORD. At this point, the Chair will invite you to speak for both Dr. Marshalls.

STATEMENT OF DR. ERNEST W. MARSHALL, WEST STOCKHOLM, N.Y.

Mr. E. **Marshall**. Senator Stafford, I am Dr. Ernest W. Marshall, a snow and ice geologist from West Stockholm, N.Y., who has recently been involved in acid snow studies on the western slope of the Adirondack Mountains.

My experience includes some 20 years of snow and ice studies in Greenland. The Arctic Ocean, Antarctica, the Baltic Sea, the Great Lakes, and the St. Lawrence River.

During March 1980, I carried out a pilot study for the U.S. Geological Survey to define geochemical horizons in the Adirondack snow cover. This was one of several studies carried out by the survey as part of a coordinated investigation in which six universities, one national laboratory, one Federal agency and a private company participated in a study of three Adirondack watersheds.

The study was the integrated lake acidification studies under the sponsorship of the Electric Power Research Institute, EPRI.

This evening I wish to briefly present a winter geological perspective of acid snows in the Adirondacks and to suggest how these concepts might be useful in defining the impact of acid precipitation in the State of Vermont.

Snow consists of the mineral ice and in layered deposits can be viewed as a white sedimentary snow-rock formation that can be compared with a white sandstone formation.

The problem of acid precipitation has been investigated primarily by aquatic biologists, botanists and atmosphere chemist. However, in northern areas for 3 to 5 months, the problem is essentially geological.

Within this context, geological time is compressed into a period of approximately 90 to 150 days. The stages of formation and erosion of these snow rocks are measured in weeks and days and hours rather than in tens of thousands or millions of years.

Thus, in this sense, acid snows are a short term geological mapping problem.

The annual Adirondack snow cover usually consists of a sequence of snow strata of wide extent deposited by major storms separated by thin ice layers caused by brief thaws.

Acid precipitation is included within this sedimentary matrix by snow and rain scavenging and dry fall. Thus, the acids are locked up within the snow cover for a period 3 to 5 months and are released in a period of approximately 7 to 10 days at the beginning of the spring melt.

The impact of these areas on the environment has been compared to a pack-a-day smoker who abstains for a period of from 3 to 5 months, 90 to 150 days, and then attempts to smoke the stored cigarettes in a period of approximately 10 days.

Each major snowfall in the Adirondacks leaves a distinctive snow layer across the mountain range which accumulates into a snow cover ranging from 3 feet to 6 feet in depth. At the end of the winter, the accumulated snows on the Adirondack Mountains could be compared in a sense to an onion cut in half.

Each layer is distinctive in its characteristics and can be traced 150 to 200 miles across the Adirondacks.

In the Adirondacks, the zone of acidified lakes identified by the work of Mr. Ptteifer, of the New York Department of Environmental Conservation, lie in a long elliptical zone along the western front of the Adirondacks above an elevation of approximately 2,000 feet.

I have found from the examination of snow records that this is the zone where the acids are stored for period of at least 70 to 150 days.

An examination of the winter snow cover would make it possible to determine acid loading over the State of one-sixth inch. At midwinter, the snow cover offers an infinite number of stations for collecting samples.

In addition, it would be possible to trace the acid deposition from individual storms bringing air masses from the Midwest, Ontario, or the Atlantic coast. In this manner, it may be possible to limit geographical zones of possible lake acidification and forest damage in the State of New York.

Senator **Stafford**. Thank you very much, Doctor.

We really appreciate your coming over here from New York.

The next speaker the Chair will recognize is Jane Dwinell from Randolph, Vt.

Voice. She is going to submit written testimony. She couldn't come here tonight.

Senator **Stafford**. All right. We will accept the written statement from anybody who asked to be able to speak and is not able to do so. We look forward to hearing from her by mail.

The next witness, then, will be the Reverend Howard Sterns of Burlington, Vt. He will be followed by Jeanne Keller of Montpelier, Vt., if she is here.

Reverend, you are on.

STATEMENT OF REV. HOWARD STERNS, BURLINGTON, VT.

Reverend **Sterns**. Thank you, Senator Stafford.

I would like to speak just very briefly to the moral concerns of the cost-benefit approach to this whole thing, questioning whether it is really correct to look at the problems of rectifying clean air as something which is too costly in order to counteract the dangers that come from it.

I am reminded of a phrase that was, I think, coined by a mutual friend of ours, Mayor Edwards, who talked about euthanasia by budget cutting. This might be euthanasia by enactment of legislation, the point being that even the most fragile ages will be hurt by some of the things in acid rain. I think that we need to be very cognizant of that.

I also call your attention to the President's report, Global 2000—perhaps you have seen that—in which it makes some very clear statements on the necessity for the United States to take the lead in producing clean air as a kind of a foretaste for the whole world.

So I speak to that and call your attention both to that and to an article by Harold Fey in the Christian Century.

Thank you very much.

Senator **Stafford**. Thank you very much, Reverend.

We are now ready to hear Jeanne Keller. She will be followed by Janine Wurster of Burlington, Vt.

STATEMENT OF JEANNE KELLER, MONTPELIER, VT.

Ms. **Keller**. Thank you, Senator. I am executive director of Vermont Public Interest Research Group.

We have 800 members who are extremely concerned about air pollution. As Vermonters, we are all very proud of the quality of our environment. We have been very careful about protecting it. We have had clean air laws on the books in Vermont since 1967, and the general assembly reaffirmed that just this last session with a resolution calling on our congressional delegation to do something about strengthening the Clean Air Act.

Senator **Stafford**. That is called preaching to the choir in our case.

Ms. **Keller**. We wanted to show our strong support for your strong support. A survey Congressman Jeffers did showed that 67 percent of Vermonters believe that environmental protection laws should be as strict or stricter than they are. Only 29 percent felt restriction should be rejected for a greater production of energy. That is pretty significant. We have significantly supported pollution control. The point of all this is to say that our clean air problems are the result of something over which we have no control. There is a serious equity problem here. The testimony this afternoon demonstrated how serious the problem of long-range transport is. We hope you do something about it.

Thank you.

Senator **Stafford**. Thank you very much, Jeanne.

The next speaker we will recognize is Janine Wurster, if she is here.

She will be followed by Sami Izzo of Quechee, Vt.

STATEMENT OF JANINE WURSTER, BURLINGTON, VT.

Ms. **Wurster**. Senator Stafford, first I would like to thank you for holding this field hearing for the Senate Committee on Environment and Public Works.

As a 4-year resident of Vermont, I am deeply concerned about the quality of the air we breathe in this State. Most Vermonters probably believe their air is relatively clean to breathe. Unfortunately, this is not the case. Our air is threatened by sources we have no control over; namely, powerplant and industry emissions from the Midwest, Ohio River Valley.

The long-range transport pollutants is poisoning our environment and damaging our health.

Because air pollution fails to heed State boundaries, Federal laws are needed to deal with the problem.

In its present form, the Clean Air Act, I feel, does not deal adequately with the problem of long-range transport.

Several provisions need to be added to the act during this reauthorization process. Currently, the total suspended particle standards fail to account separately for fine particulate pollution. This causes visibility problems for one in the Vermont area, which hurts Vermont industry.

It is these fine particulates, also, that cause the greatest damage to the human respiratory system. Fine particulates and sulfate, which is the cause of acid rain problems, must be added to the list. This will control the source of our acid rain problems by bringing the long-range transport problem to public attention and initiating national regulations at the source.

Industry arguments are based on the cost of pollution control. They fail to take into account, however, the fact that air pollution is destructive to farm and alpine vegetation, the surfaces of buildings and human health. We cannot sit back and wait for conclusive scientific evidence which testimony today, scientists said, estimated it would take 3 to 4 years to produce. Pollution control technologies are needed now and must be used to prevent further damage.

Scientific evidence is even scarcer concerning the recovery of the natural ecosystem after pollution damage has occurred.

The Clean Air Act must include standards for acid rain causing pollutants from existing powerplants, as well as from new ones.

Vermonters need a Federal regulatory program to help control the acid rain problem. It is important to realize that the voting public is not for acid rain and we support you in your continuing fight to keep the Clean Air Act strong.

Senator STAFFORD. Thank you very much indeed.

The next witness is Sami Izzo, to be followed by Harold Richardson, who will mention the impact of fishing in Vermont.

Sami, you are on.

STATEMENT OF SAMI IZZO, QUECHEE, VT.

Ms. Izzo. Thank you.

The Clean Air Act provides the vehicle for protection of the most precious of our natural resources, the air. Everyone needs it to survive. Our atmosphere provides the opportunity for life forms to exist on this third planet from the Sun.

During the reauthorization of the Clean Air Act, which is our vehicle for protecting this life-giving natural resource, the emphasis needs to be on how to best fine-tune the components of the act to exercise the mandate.

As others have pointed out today, certain programs are now under attack, and they must be maintained.

The prevention of significant deterioration program is vital to areas with clean air, like Vermont. It should not be just our natural parks, important as they are, that retain that quality that provides a lovely vista and clear blue skies. Our rolling Vermont hills are just as important a view.

If the area is off the class I status that comprises only 1 percent of the United States that are the only areas with good, clean air, can you imagine if everyone who enjoys that vista has to go to just those areas to find it?

The National Ambient Air Quality Standards for the seven pollutants named need to be expanded to include the ozone precursors, and the elements of acid deposition. The harmful components of the total suspended particles are currently not adequately regulated because the measurement is in weight, not by the number.

The most adverse particles, such as the sulfates, are below 2.5 microns.

We found that with the advent of alternative energy utilization that we need so much in this country we have a challenge to prevent new advents of air pollution and avoid the mistakes from the superstack concept, which said, "Dilution is the solution to pollution." We found out how it was wrong.

Acid deposition and other components of long-range transport air pollutants are not currently adequately addressed. During this reauthorization, this problem must be faced. There is enough evidence to cause alarm.

Regulation of the precursors will reduce the impact which is sure to conclude in 10 years' time.

One comment on the proposal to introduce a cost-benefit analysis: To utilize these concepts of unreasonable risk being determined by considering attainability of the standards and economic values is to place a dollar value on intangible benefits of health and of well-being. In addition, all costs fluctuate, and often, when faced with the necessity of compliance the challenge becomes finding innovative, often cheaper means of control so that that estimated and hypothetical cost-benefit analysis is no longer valid.

As a staff member of the Vermont Institute of Natural Science in Woodstock, I am daily reminded of how the people of Vermont and those who come to visit cherish our obvious beauty and the harmony that they find in our State.

The board of trustees of that organization has decided that this political issue is important enough to the integrity of the natural resources of Vermont to support the resolution to help keep the air clean.

Last, for the last decade, I have considered myself a steward of this Nation, working to protect the natural resources which provide me with my means of livelihood.

Now, my concerns have become more personal. By this time next year, I will be a mother, and want to provide a healthy environment for my child so that in the year 2000, he or she can stand here, just as I am, in support of a strong reauthorization of the Clean Air Act.

Thank you.

Senator **STAFFORD**. Thank you very much, Sami.

I think what you were saying was, in part, we want to be sure the air is clean enough 5 years from now so the young man who was carried out here in a few minutes more will have good air for his children to have.

Harold Richardson, you are next, followed by Eleanor Swain.

STATEMENT OF HAROLD RICHARDSON

Mr. **RICHARDSON**. Thank you, Senator.

I think you have heard from me on a good many issues in the past.

This is one issue that concerns me very much because I attempted to make a living as a fishing guide in the State of Vermont and a hunting guide. Now, if we are going to let happen in Vermont what has happened in the Adirondacks, there will be no fish.

I recently talked to two people from Albany, N.Y., who have camps up in the Adirondack Mountains. They tell me, "We don't even go there anymore. We have camps, but there is no fish in the lake. We don't even care to drink the water anymore."

Do we want that type of thing to happen in the State of Vermont? Not I.

I have a written statement that I am going to present to you, as soon as I get home and send it to you, because I forgot it.

Senator STAFFORD. Whenever you wish, we will include in the record.

Mr. RICHARDSON. Thank you.

When I walked into this place, a certain lobbyist in the back of the room says to me, "Well, well, here we are, Mr. Richardson, the representative from Vermont Alliance, the people's low-income man; the welfare advocate."

He said, "You know something? What happens in this hearing is not going to amount to anything because the President of the United States has made a decision on what is going to happen."

I hope that is not true. I hope that, Mr. Stafford, that you, as chairman of the committee are not going to let our pollution laws backslide and that we are not going to have to give up the fresh and clean air of our State to make people rich through industry.

That is all I have to say.

Senator STAFFORD. Thank you very much.

Ms. SWAIM. I am sorry, sir, I forgot my speech.

Senator STAFFORD. If you like, if you care to send it to us.

Ms. SWAIM. I am not an experienced enough speaker.

Senator STAFFORD. We will be glad to put a statement in the record for you, if you wish.

Mr. Richardson, I would say I have often commented in other parts of the country that if fishing gets so bad in this country as a result of pollution that the fishermen can't catch anything, I think they will be able to raise a storm that will make the national gun lobby look like a tempest in a teapot.

We will pass on Eleanor Swaim until she sends us a statement for the record. We will hold the record up for that.

The next speaker, then, we will recognize will be Bob Gray of Four Corners Farm in Harland, Vt., to be followed by Curt McCormack of Rutland.

Bob Gray? Is Curt McCormack here?

Curt McCormack of Rutland, Vt., which happens to be my favorite town.

STATEMENT OF CURT McCORMACK, RUTLAND, VT.

Mr. MCCORMACK. I am here to urge you to strengthen the Clean Air Act.

Without getting into how many people die each year as a result of air pollution, or of our particular concern here in Vermont, acid rain, I would like to talk about the debate over the Clean Air Act. The whole concept in imposing clean air standards on industry, only one economically supported, is an outrage. It is an insult to our sense of priorities.

The ironic thing about it is that the economic argument hardly holding water anyway. It was reported that the Reagan administration proposes an elimination of 34 safety and emission controls on automobiles in order to spur auto sales. The report said that this would cut $150 dollars off the price of the average car.

A new car costs $6,000 now. Do they really think that $150 off $6,000 is going to make a difference between someone buying their car or not? I think the radio on a new car costs about $150 now.

The election results of 1980 were a clear mandate that the Americans are tired of high taxes, inflation, and unnecessary Government spending. But did they mean, as well, that we should slow down the fight against air pollution? I don't think so. A Harris poll taken in 1979 found that 69 percent of the respondents favored a reduction in Federal spending.

When asked if they would support a major cutback in spending for environmental protection, a majority of 57 percent said they would oppose such a cutback.

The Clean Air Act was a big step towards solving an enormous yet, for the most part, correctible problem. In the months to come, I hope you will consider people's health the priority and therefore strengthen the act.

Thank you.

Senator **Stafford**. Thank you very much Mr. McCormack.

The next speaker we are going to recognize will be Mr. Peter Gratiot, who is a private pilot, as is the chairman of this committee.

He will be followed by Constance Silver.

Mr. Gratiot, how are you doing?

STATEMENT OF PETER GRATIOT

Mr. **Gratiot**. Senator Stafford, rather than read a letter which seems a little formal, I would just like to make a couple of remarks about how much I think has been accomplished by the clean air laws we now have.

You refer to the fact that I am a private pilot, have been for 40 years. I have been particularly concerned about the air quality that is visible to the VFR kind of pilot I have always been.

Ten years ago, we had a brown ring around us throughout this country, let alone in New England.

It was a brown haze that was the result of pollution. It has been my belief that this change in our air quality and the reduction of the air pollution is visible air pollution to the point where now we don't see this brown ring; where it is blue sky that is surrounding us, was the result of, I thought first, the automobile emissions. To what extent this has also been attributable to changes in the pollution controls on powerplants, I do not happen to have specific knowledge. I hope you have received testimony on that point today.

Don't let the Senate, if you can help it, change this set of rules. We need these. It is a magnificent change that we accomplished in this country, and we should not backtrack at this point.

Thank you for holding these hearings, Senator.

Senator **Stafford**. Thank you very much.

Now, Constance Silver, who is a restorer of historic monuments, to be followed by James Watt, M.D.

I might say he is one Watt that we are glad to have here.

STATEMENT OF CONSTANCE SILVER, RESTORER OF HISTORIC MONUMENTS

Ms. **Silver**. Thank you.

Senator Stafford, I have just returned about a year ago to Vermont after working abroad for several years in historic preservation. I worked for a number of American foundations. I worked for the International Center for Conservation in Rome, and I also worked for UNESCO and UNESCO projects.

Since I have returned, it has occurred to me that our historic graveyards are rapidly deteriorating, at least in my part of the State, and I have noticed that a number of abutments on historic buildings are also being affected.

From my experience in working in the historic centers of Rome and Venice, I tend to believe that one of the major problems that we are seeing now is air pollution.

I cannot really prove this in Vermont because I have only now begun my own research on this problem, but I can tell you something about my own experiences in the historic centers of Venice and Rome.

I think it is probably no secret to anybody here what air pollution does to monuments, especially those monuments that are made from calcium carbonate stones. If given the chance, in about 20 years, it can utterly destroy them.

I suppose that there are many people who might believe that the price for industrialization is very low if we could count the destruction of every historic tombstone in this State. I myself, don't believe that it is in any way a low price to pay. I think that we can encounter terrible problems of historic preservation if air pollution is allowed to become a tremendous problem in this State.

The reason I think that we will find that it will be a very expensive problem is because first of all, I think that Vermonters care as much about their historic patrimony as the Italians and the English and the French and the Turks and the Jordanians. These are all places in which I have worked.

I don't think Vermonters care any less about these things than other people do.

The other point I wanted to make is that if we have to put everything into a nickel and dime sense, tourism is an extremely important part of the Vermont economy. People come to Vermont to see our natural resources. They also come to Vermont to see our cultural resources. Our architecture is wonderful, and our historic cemeteries are great depositories of folk art and folk sculpture.

People come to see these things. They won't if these categories of our patrimony dies.

In my experience, people don't generally stand by and allow their works of art to fall apart. They demand that they be treated, and the price is becoming increasingly more expensive.

I think that before air pollution begins to totally destroy our cultural patrimony, we ought to think about what the price is going to be in terms of our financial and our cultural orientation in this State.

Thank you.

Senator STAFFORD. Thank you, Constance.

Now we are prepared to recognize Dr. James Watt.

STATEMENT OF JAMES WATT, M.D., PAST DIRECTOR OF THE NATIONAL HEART INSTITUTE AND ASSISTANT SURGEON GENERAL, PUBLIC HEALTH SERVICE

Dr. WATT. Thank you, Mr. Chairman.

My name is James Watt. I am a doctor of medicine, a doctor of public health.

Senator **Stafford**. I think it might be well if you note that your past record was as Director for the National Heart Institute and Assistant Surgeon General.

Dr. **Watt**. Yes.

I have had some experience with the dangers of pollution to people whose health is already impaired. It is perfectly obvious to everyone that bad air hits hardest on those who are less able to take care of themselves.

I find it extremely difficult to understand why there should be, at this stage of the game, any real problem about reenacting this act, not only reenacting it, but strengthening it and bringing it out so that it takes care of the deficiencies which have been brought out.

For example, in attempting to clean the air locally, many of our industries have built stacks that go up a long way. This, in turn, has led to problems in States that had none of their own. We have heard a lot of talk today about the problem of acid rain in the long term.

Here again, no small part of that is—in a way, it is ironical, because in a way it was a response to try to clean up the air locally that it was suddenly put up, and the neighbors suffer. I think it has been one of the real weaknesses, I suppose, in the act itself, that we were not able to effectively set up a monitoring system that would let us know what the long-term results are; and at the same time, let those people who are in—I think the word is "attainment"—those who are in that State be able to know when the air around them is deteriorating.

I can only—I won't go any further on the details of that. I would like to associate myself with previous speakers and take you to earlier this morning. Johannas Von Trapp gave a statement which I think covers most of this. I would like to make a suggestion which I think may have some practical value.

For many, many years the U.S. Weather Bureau has used a system of volunteers scattered all over the country, and, in fact, all over the world, through ships at sea, in collecting information which is fed into a central place. With the ability which we now have with the computer and with the type of ability to digest masses of data, I think it is essential that we set up a simple monitoring technique analogous to those which the Weather Bureau has used there. They are trained, the people that feed information are trained in how to collect certain information which is, in turn, brought into a central place and, in turn, this is used to build up the weather maps.

It does two things: It lets the local people know know what is going on locally, but at the same time it gives them a basis for knowing how to make a comparison.

An analogous setup could be developed for monitoring air with a few simple measures. Acidity is easy to measure. Any high school chemistry or physics class would incorporate such a measure in their curriculum. This could be done. If it was done in a systematic and standardized way, this would be fed into a central collecting place where you could recover it. This way you could know, at least for the things which you have selected as good data, a way in which we could determine, for ourselves, when there is a deterioration in the air quality. We would know what to do then. We would be able to find out where it is coming from and do something about it. Now we are really helpless.

We see a smog. We see it, but we don't know where it is coming from. We don't really know that it is any worse than it was last week. But with a systematic way of monitoring it, just as the Weather Bureau set it up, knowing how much rain there is here, there could be a network built up with the cooperation and enthusiastic participation, I am sure, Mr. Chairman, of many people that have done it.

There is nothing people like better than to know where they are and how they stand.

Thank you very much for this opportunity to talk to you.

Senator **Stafford**. We thank you for a good statement and a very valuable suggestion.

Next we are prepared to recognize Daphne Gratiot, to be followed by Leigh Seddon.

STATEMENT OF DAPHNE GRATIOT, VERMONT WOMEN'S POLITICAL CAUCUS

Ms. **Gratiot**. Thank you for coming to Randolph, Senator.

Everything in this world cannot be boiled down to an accountant's analysis of cost-effectiveness.

We are paying a very high price today for the application over many yesterdays of this kind of standard. In the Love Canal, the disposal of drums of poisonous chemicals was very cost-effective for certain companies 15 or 20 years ago. Lake Erie is dead as a result of tons of toxic materials poured down the Maumee, the Cuyahoga, and numerous other beautiful rivers, which are now dead like the lake they feed.

This was very cost-effective.

In the United States, as in the rest of the world, men, in their rush to create growth and make profits, have not proven themselves to be totally omniscient as regards the future damage they may wreak on the air they need to breathe, the water they need to drink, and the soil they need for their nourishment.

Today, we have an administration which trumpets that all social and economic ills in this country can be solved by giving free rein to private industry. We have been down this road before. It was my childhood.

But in my adult years, I have seen a government that enacted legislation to restrict and control those who would use the environment as a monstrous public sewer and sometimes, at great public cost, we have seen the air and water restored to a semblance of its former state.

We must not go back to what one President and one administration claims is the good old days. The 1930's were not the good old days for many of us. The 1940's were not the good old days, nor were the 1950's the good old days. We are better off here in Vermont now, in the 1980's, with the Clean Air Act and many of the programs which have just had their guts torn out by a nonthinking Congress.

What will it benefit the United States to have a few jobs this year in factories that belch pollutants into the air and spew poisons into the water, when the next generation finds their environment has reached the point of no return?

We are grateful to you, Senator Stafford, for coming to Vermont and listening to our concerns about our environment.

I ask you to remember us when the bargaining begins in Washington on reauthorization of the Clean Air Act. I think it highly likely that a few years down the road, this Nation will remember with deep gratitude those who stood firm in 1981 and gave the benefit of the doubt to preservation if the air, the water and the soil of this Nation.

Thank you.

Senator STAFFORD. The Chair will next recognize Leigh Seddon. Leigh will be followed by Dr. William Ballard.

STATEMENT OF LEIGH SEDDON

Ms. SEDDON. Thank you, Senator.

Senator STAFFORD. Leigh?

Ms. SEDDON. I would just like, quickly, this evening, to voice my concern about acid rain in Vermont and New England, and my particular concern is about the weakening of the Clean Air Act. My first visit to Sudbury, Ontario, was in 1970. Sudbury is the home of the world's largest nickel, a big nickel. It is also one of the largest nickel, copper smelters in the world.

I had no idea when I took the train through Sudbury what I was going to see, but 10 miles outside of the city, the vegetation disappeared, and so did the soil. There was literally nothing living on the ground, pure rock. This was from the sulfur and nitrogen oxides.

Since 1970, I have had the opportunity to pass through Sudbury about five or six more times.

They have cleaned up their pollution remarkably. They have put on pollution controls, but most notably, they have built a taller stack. This has simply transported their oxides further downwind to North Ontario and Quebec.

In a recent article I read in a newspaper some Quebec residents were talking about losses of their maple sugar crop which is very pH sensitive. I have a feeling that Sudbury, Ontario, and the horrors that I saw there 10 years ago are moving into New England and Vermont.

You are all aware of the Northeast damage report, I am sure, that says what acid rain has done in New England; the Adirondack Lakes; high levels of mercury in fish in Maine; soil lead levels in soil are increasing; in one estimate, 50,000 premature deaths, nationwide, due to sulfur, in 1980. These are some of the items in the Northeast Damage Report that I found very upsetting.

To think that the Clean Air Act, which would control these emissions and help reduce acid rain, would be weakened is just unthinkable in terms of economics and also in terms of human health in our environment.

As a resource economist, I would like to make one final note about cost-benefit analysis. I use cost-benefit analysis quite a bit in dealing with environmental problems and research that I do.

One area that I don't think is suitable to cost-benefit analysis is air pollution and human health. A few of the reasons are: That cost-benefit analysis relies on quantifying both the costs and the benefits. The costs of putting scrubbers onto control equipment is well known. You can get it down to dollars and cents.

But the cost of human health is something again. What is the cost of one death? Is it the cost of work foregone and medical care? Is it the cost of life insurance that that person carried, or is it priceless? That is something that no economist, and I don't think any Congressman or American citizen is willing to put a price tab on, human life.

Another reason is that while costs and benefits can be balanced sometimes if all the figures are known, there is some gross inequity that occurs. If a certain level of pollution is deemed to be justified on a national level, balancing costs and benefits, what happens is there is a transfer of wealth or money from the people who are still experiencing damage to the people who are producing the pollution. Thus, a farmer in Vermont whose maple sugar crop is reduced will be subsidizing utilities in Ohio. Unless some system of compensation is worked out, this is unjust. I don't think any system could be worked out. Those are several of the reasons I think cost-benefit analysis does not work in the area of air pollution and especially acid rain, which is a long-distance, international kind of phenomenon.

I think I would like to see that the new EPA performance standards go into effect for new powerplants, but also, that performance standards such as these for old powerplants go into effect.

I think this has probably been mentioned all the time. But it is important to remember the plants that are producing acid rain right now.

Finally, I would say in terms of cost-benefit analysis, I am not opposed to having something cost-efficient, and that there is no need to regulate that there will be a scrubber on this plant or such and such on this plant. I think we should leave it up to private enterprise and the free market, if you will, but establish performance standards; say how much pollution we want, preferably, and the amount of pollution that will leave crops and human health undamaged. If we set the standards any lower so there is damage, we are going to get this transfer of wealth and, of course, unwanted damage to our society.

That is about it. Thank you.

Senator STAFFORD. Thank you very much.

As an editorial comment, the chair would note that when you go into cost-benefit analysis and talk about what the human life is worth, that recently in Washington, one jury found a human life was worth over $9 million. In another case, over $4 million. But some insurance actuarials decided that a man my age, 67 plus, was only worth $37,000.

Dr. Ballard will be followed by Lowell Krassner and Peter Smith. Dr. Ballard?

STATEMENT OF WILLIAM BALLARD, NORWICH CONSERVATION COMMISSION, NORWICH, VT.

Mr. **Ballard**. I am a biology professor emeritus at Dartmouth. I am residing in Norwich, Vt. I am speaking for and here at the request of the Norwich Conservation Commission.

As you know, following the guidelines of the Vermont Enabling Act, the Municipal Conservation Commission is charged with making an inventory of the town's natural resources and making recommendations as to their wise use.

One of the natural resources we are totally powerless about at the local level is air.

With regard to this essential resource, our town, like all of Vermont, is enveloped in smog and toxic pollutants from farther West, and our only real protection is through the Federal Clean Air Act. We, of course, get reports of the air monitoring from Dartmouth College and from Hubbard Brooks scientists in the White Mountains. We don't lack for things to read about it.

We come here powerless, simply to applaud you, what you, Senator, are saying and doing toward strengthening and finetuning the Clean Air Act. We urge you to resist with all your power and skill the breakdown of this, our own protection, against the invasion of Vermont by air-borne garbage and poisons from industries farther West.

We particularly fear the weakening of the present act by the introduction of cost-benefit approaches to regulations and controls; for instance, through the amendments being submitted by Representative Broyhill.

I dare say on the behalf of malefactor corporations of great economic power and small social conscience to balance dividends short-range against the health and welfare of the general public by a regulatory agency that could surely be packed with industrialists and under the proposed amendments given power to disregard the original purposes of the Clean Air Act when convenience seems to us not quite the way to get the Government off the backs of the people.

We endorse your much-quoted views as to the injustice of having these air-borne wastes poured out over Vermont by industries farther West to the detriment of our own potential for industrial development here.

We share, in general, the views about the Clean Air Act and the need for strengthening it already expressed last month by the Vermont legislature in its joint resolution; and we agree with the positions in general taken by the national and the Vermont Clean Air Coalitions.

I want to comment on a suggestion from the Vermont Fish and Game Department quite recently, that acid precipitation on Vermont may not have the severe effects seen in areas of the Adirondacks, Canada and Scandinavia, because of the buffering capacity of our limestone rock and soils.

If you get a bit east of the backbone of Vermont, this makes less sense. My area, for instance, does not have rocks and soils with these buffering capacities. I am unaware who may be looking to damage our fish life in eastern Vermont, but I believe it can be found. I happen to be a fish embryologist. Every spring, I visit our heavily-used spawning sites of the yellow perch to get employees for research.

That is the time when one can see the perch population. It is also the time when the winter's accumulation of acid snow is being meted and flushed toward the Connecticut River. It is my firm opinion that in my area the perch population has diminished by at least half, perhaps two-thirds in the last decade. I can't prove that the cause is acid precipitation, but what other new factor is there?

It is a little disturbing to think that we might restore the Atlantic salmon and then have the population killed off by acid rain.

Thank you very much.

Mr. Krassner, representing Vermont Wilderness Association, will be followed by Steven K. Rice of the Appalachian Mountain Club.

STATEMENT OF LOWELL KRASSNER, VERMONT WILDERNESS ASSOCIATION, ACCOMPANIED BY PETER B. SMITH

Mr. **Krassner**. Thank you, Senator Stafford. I am here to speak on behalf of the Vermont Wilderness Association, which is interested in the preservation and protection of wilderness areas in Vermont and natural areas. Obviously, you have heard a lot of testimony today about the effects of acid rain on mountain environments and waters and fisheries and wildlife.

This is our primary concern, as well. We want our wilderness areas that we do have protected to be preserved in a natural state. It can't be if acid rain is destroying the fish life and hurting the forests and vegetation.

We urge you very strongly to support the strongest possible strengthening amendments to the Clean Air Act. One of our members who lives in and over in the southern part of the State has very graphic evidence without scientific instruments of the effects of acid rain. He claims that he can tell where the snowstorm came from by tasting it.

When they have come across from the Midwest, they are sour, just to the taste. When he picks up snow that has fallen over the Northeast, over the ocean, it doesn't have that sour taste. It doesn't take a great deal of scientific technique to taste the acid. You just have to use your tongue. Obviously, we are suffering from it.

I would like to add one note on a personal level on my own behalf. People have been talking about health and marginal life and so forth. Right now, my lungs are healthy and my heart is healthy. I don't know where I will be 20 years from now. If I happen to be somewhat diseased, I don't want to suffer and lose a few years of my life because of bad pollution. I think an appropriate question for Mr. Broyhill and Mr. Watt might be how much price do they place on a few extra years of their lives?

Senator **Stafford**. Thank you very much, Mr. Krassner.

Mr. Steven Rice is next, followed by Mr. Bob Linck. Mr. Rice is here for the Appalachian Mountain Club.

STATEMENT OF STEVEN K. RICE, APPALACHIAN MOUNTAIN CLUB

Mr. **Rice**. Thank you, Senator Stafford.

I am director of North Country Operations for the Appalachian Mountain Club. I formerly served as director of the Green Mountain Club here in Vermont. The AMC is a 105-year-old conservation organization of 25,000 members. In the Northeast, we maintain over 500 miles of hiking trails; 30 back-country facilities; in doctrines of service; and a program of land stewardship and research and conservation. We have 11 chapters located throughout the Northeast. Our newest chapter is based here in Vermont.

The AMC is deeply concerned about the impact of acid precipitation upon the northern United States. We have studied the documentation of the adverse impact of acid precipitation on the Adirondacks and share equal concern for the Green and White Mountains and other natural areas and bodies of water in the Northeast.

Two investigative articles have appeared in our primary publication on acid precipitation. We have directed our research program to Pinkham Notch to make research on acid precipitation a high priority. Already our staff is cooperating with the University of Maine at Orono to document the effects of acid precipitation on the high mountain ponds located along the Appalachian National Scenic Trail. We feel the sulfuric and nitric acids which fall on the region largely is as a result of the heavy industrial emissions in the Midwest which pose a serious risk to the environment of the Northeast and to the health and the economic well-being of its people.

Because the Clean Air Act is coming up for review and revision and since the act is presently worded to lax clear provisions to direct the Environmental Protection Agency to regulate long-range transportation of air pollutants, Congress has the opportunity to strengthen the act and to deal with the acid precipitation problems.

I strongly recommend that Congress act in this regard. I guess the buck starts with you and your committee in the Senate.

Furthermore, we recognize that the Federal Government in cooperation with State agencies, universities and private organizations, support more appropriations, continued research into the sources and impacts of acid precipitation in the Northeast. Thank you for holding this hearing on probably one of the key environmental issues of the 1980's.

Senator STAFFORD. Thank you very much, Mr. Rice.

Bob Linck represents the State of Vermont but lives in New Hampshire; is that correct?

Mr. LINCK. Yes.

Senator STAFFORD. You will be followed by Martha Lyman.

STATEMENT OF BOB LINCK, CONNECTICUT RIVER WATERSHED COUNCIL, HERMAN, N.H.

Mr. LINCK. I am associate director of the Connecticut River Watershed Council, representing a constituency of nearly 300 citizens and businesses in Vermont and concerned with a drainage area of 3,928 square miles in this State, the Connecticut River Watershed Council is deeply troubled over attempts by industry, the new administration and certain Members of Congress to weaken the Clean Air Act during its reauthorization period this year. Such attempts are guided by the application of cost-benefit analysis, weighing industrial profits and environmental quality. The Watershed Council feels that this approach is unacceptable because it does not fully account the costs of air pollution.

If we sort through the many important issues involved in the reauthorization of the Clean Air Act, long-range transport of pollutants and the fall of acid precipitation stands out as the most critical concern for residents of the Northeastern United States.

Though it has emerged as perhaps the most frightening environmental hazard in New England, the acid rain continues to fall, and now we are being asked to accept the relaxation of the emission controls over the smelters and coal-burning plants which are creating the acid rain.

Perhaps the most immediate impact of acid rain is on fish life in our lakes and rivers. Though the precise effects are complex, there are two major categories of impact: Direct toxic effects and effects on reproduction.

Toxicity of heavy metals such as lead, zinc and iron is enhanced under conditions of increased acidity. Trace quantities of these metals can have disproportionately harmful effects on fish. Acid rain also leaches aluminum from the soil. In soluble form, the aluminum reaches the fish's gills and inhibits oxygen exchange.

In addition, increased acidity limits or eliminates changes for successful reproduction among fish. When the pH of water drops below 5.4, Atlantic salmon reproduction is threatened and below 4.7, it cannot occur.

Is it possible that in the next 20 years we will watch our lakes and rivers become devoid of fish life? There is ample evidence to suggest that this is more than a mere possibility.

It is, in fact, a likelihood if we do not act.

Over 200 lakes in the Adirondacks of New York State, nearly 10 percent of that region's total, have lost their fish life. More than 200 lakes in Ontario have had a similar fate. Nine rivers in Nova Scotia and seven major rivers in southern Norway have lost their once abundant Atlantic salmon, all because of the acidified water resulting from acid rain.

If we observe such frightening data and continue to do nothing to strengthen the Clean Air Act provisions which control sulfur dioxide emissions, or worse, allows these provisions to be further weakened, then we most assuredly will watch our lakes and rivers die. The economic consequences may be severe, even if we restrict our attention to the sport fishing implications.

Total Federal, State and private expenditures for the Atlantic salmon restoration program, of which the Bethel Natural Fish Hatchery and the beautiful White River in Vermont are essential components, now exceed $100 million. Such an investment should not be taken lightly.

In addition, 1981 estimates place the yearly income from sport fishing in Vermont at $84 million. To put this in proper perspective, the ski industry brought $120 million into the State this year.

Should the acid rain problem persist, it is conceivable that we could lose both investment and the salmon restoration program, and in Vermont alone, yearly income of $84 million from sport fishing.

The Connecticut River Watershed Council feels that Congress should make a firm commitment toward strengthening, not weakening the Clean Air Act; in particular, those regulations controlling sulfur dioxide emissions.

Furthermore, coal power generating plants should be brought under current emission control regulations, and maximum emission standards should be imposed on all facilities which convert to coal. We feel that, economically, the short-term gains from relaxing emission standards do not justify the long-term consequences.

Thank you for this opportunity to speak.

Senator STAFFORD. Thank you.

We next recognize Martha Lyman of the New Hampshire Citizens Task Force on Acid Rain, if she is here. If she is not and wishes to send a statement, if anybody knows her, we can put it in the record for her.

We will next recognize Diane Geerken of the Vermont Sierra Club, if she is here.

STATEMENT OF DIANE GEERKEN, VERMONT SIERRA CLUB AND VERMONT CLEAN AIR COALITION

Ms. GEERKEN. My name is Diane Geerken and I am chairman of the Vermont group of the Sierra Club.

As the Vermont Sierra Club representative to the Vermont Clean Air Coalition, I want to express our appreciation for the effort that has gone into holding this hearing here in Vermont, so Vermonters can be heard on the issue of the Clean Air Act reauthorization.

There is ample indication in news reports that national battle lines have been drawn between those who wish to preserve the gains made and prevent further deterioration in air quality, and those who seek to weaken the act to the point of making it completely ineffective.

In Vermont, we are quite aware of how much we have to lose, in particular if provisions of the act are changed to permit deterioration of air quality in areas which are now cleaner than the minimum standards require.

Clean air is valuable to those of us who live here as well as to those who visit our State in search of crisp, clear country air. We have accepted regulation of pollution sources as the means to preserve the quality of clean areas and to improve the quality where some standards are not now being met, sources mostly in Chittenden County.

If class II and III PSD increments are eliminated, air in our rural areas will be allowed to reach the levels of pollution which now prevail in urban areas around the Nation. We have taken steps to control sources in Vermont, but would be subject to rising levels of contamination here from sources in other States. This is totally unacceptable to us.

The Clean Air Act is a law which appropriately places with the Federal Government the responsibility for creating and maintaining minimum clean air standards. It is foolish to claim that if each State were to set its own emission standards for pollution sources, without regard to effects beyond that State's borders, an acceptable level of air quality would result.

Economic competition would gradually erode higher standards, and there would be divisiveness among the States because of the frustration in trying to deal with a condition which does not respect State boundary lines.

In the Northeast we have become increasingly aware that we are subject to the effects of acid rain. It is quite evident that the acid falling on us is created by emissions to the south and west of here. Without Federal regulation which addresses this condition, we are unlikely to get relief. We believe that Congress must recognize this situation and pass a measure which treats the problem from a national perspective.

Americans have consistently shown their support for strict clean air standards. We implore Congress to pass a reauthorization bill with high standards and meaningful enforcement procedures.

Thank you for coming to hear us, Senator Stafford.

Senator **Stafford**. Thank you very much.

The Chair will recognize a surrogate for Andrew Stout, if there is one here.

Voice. Mr. Senator, since Andrew Stout is not here and has not given me his statement, I believe he will submit it to you in writing.

Senator **Stafford**. We will, in that case, hold the record open for him to submit a statement to us, if he wishes to do so.

Voice. Thank you.

Senator **Stafford**. We will then move on to Sonya Schuyler of the League of Women Voters of Vermont, who will be followed by Angeljean Chiara of the New Hampshire Lung Association.

STATEMENT OF SONYA SCHUYLER, LEAGUE OF WOMEN VOTERS OF VERMONT

Ms. **Schuyler**. I am Sonya Schuyler, the natural resources chair for the League of Women Voters of Vermont. I would wish to read this statement of the League of Women Voters to this hearing.

One of the political movements of the eighties has been new federalism, in which both the States and the Federal Government are reexamining their respective roles and responsibilities. In light of this movement, the League of Women Voters of Vermont would like to examine interstate air pollution and local, State, and Federal responsibilities for air quality.

The league recognizes that clean air is a responsibility which must be shared by all levels of government. State and local governments through their roles in protecting public health, and in planning for economic development and transportation, have a responsibility for the air quality within their boundaries. However, the ultimate responsibility for air quality standards and the enforcement of these standards must rest with the Federal Government. Air pollution cannot be confined by political boundaries.

The State of Vermont recognized its responsibility for clean air in 1967 be enacting a statewide air pollution control law, and initially Vermont's standards were stricter than the Federal standards. The State has adopted an air quality implementation plan that fits the State's specific problems. State air quality officials work with local communities to correct existing problems.

The record of Vermonters has been good. Pollution control devices have been installed where needed; large facilities have switched to cleaner fuels, and open burning at town dumps has stopped.

Despite these efforts, we still have problens. Ambient levels of sulfate are as high in Vermont as in most industrialized States, even through the State has the lowest emission rate in the continental United States.

Sulfate particles are a threat to human health and are part of the acid rain problem. Summer haze often obscures the panorama of the Green Mountains; and our air quality officials tell us the problem is air pollution, not moisture.

Rain with a pH less than 4 has been measured on top of Mt. Mansfield; and as a data start coming in from the new statewide rain monitoring system, a grim picture emerges.

On June 5, 1980, rain in Westover was measured with a pH of 2.75, the lowest reading so far in the State. June 9 of this year, the Woodford station near Bennington reported rain with a pH of 3.94; and on June 22, little more than a week ago, the Westover station reported rain of pH 3.67. Pure rain has a pH between 5.6 and 5.7. Acid rain hurts fisheries, and recent evidence suggests that it may also have long-term effects on forest productivity.

Vermont's tourist industry depends on the State's scenic attractions and fisheries for its summer season, and forestry is an important industry in the State. Therefore, loss of visibility and acid rain are economic problems as well as enviornmental ones.

Around 500 Vermonters a year die from lung diseases, and air pollution is a factor in the development and severity of these diseases. While most of Vermont is classed as a clean air area, we do have our trouble spots. Three counties in the State do not meet the Federal ozone standard, and the greater Burlington area and Barre City do not meet Federal standards for total suspended particles. Just how much more can Vermont do alone to remedy these problems?

Our problems stem from motor vehicle emissions and long-range transport of air pollution. The motor vehicle sales in Vermont are not large enough for Vermont to dictate emission standards to the auto industry, our rural population is not easily served by mass transit, and Vermont is not such an important center of commerce that it could place requirements on truck fleets. Emission standards for mobile sources must be made and enforced at the national level. Much as we would like to do so, Vermont cannot close its borders to acid rain and pollution carried on the wind. Measures to deal with these problems must also be taken nationally.

As a State we have accepted our responsibility for clean air. As citizens we must demand that the Federal Government accept its responsibility to set the necessary standards and enforce them. Shared responsibility is the heart of the Federal system whether it is the "new federalism" or the old one of the Founding Fathers.

Thank you very much for giving us this opportunity.

Senator STAFFORD. Thank you very much.

We are now prepared to hear Angeljean Chiara of the New Hampshire Lung Association, who will be followed by Joan Stevens of the same association.

STATEMENT OF ANGELJEAN CHIARA, NEW HAMPSHIRE LUNG ASSOCIATION

Ms. CHIARA. Good evening, Senator. Thank you very much for coming. My name is Angeljean Chiara. I work for the New Hampshire Lung Association. We are a nonprofit voluntary health organization. We are the oldest one in the State. We have become known as the Christmas seal people and the clean air people in New Hampshire.

As a result, 90,000 citizens contribute to our organization every year. We feel that it is our duty at this point in time to try and work our wonders for good respiratory health. Basically, I am not a medical professional. I am not an environmental expert. I am a businesswoman, and since my budget always balances, I kind of figure I am a good businesswoman.

I would like to explain as simply and effectively as I can that poor health practices simply are poor business practices as well.

If I can use examples—again, acid rain, we have heard a lot about acid rain tonight, but what a lot of people haven't made a statement about is that acid rain just doesn't come down when it rains out or snows out. On a clear day like today, there is acid particulates in the air that are respirable which means they are small enough to make it all the way into your lung and big enough once they get there to do damage.

If you are a person with asthma, bronchitis, or emphysema, you have incredible problems. If we can just take a look at those small groups of people that might have a problem because of chronic lung disease, you see that they are going to end up in the hospital more often because they are having asthma episodes that were ticked off by pollution problems or they have to be indicated because they are severe emphysemics. This would not happen were there not as much pollution. As a result, health care costs go up; the insurance premiums go up. If your insurance premiums go up, your employee benefits package goes up. I would like to see what happened to the Federal budget every time that Blue Cross-Blue Shield had an increase. My taxes probably would go up.

This simply is not the money that you would save, or the money that business and industry claims they would save by weakening the Clean Air Act.

We are basically not taken very far when health care costs and other things will make the employee's benefit go up. We are the ones that get it in the end. Their cost per product will go up. It is neither time-effective nor cost-effective. It is a lot of man-hours that are lost in there.

Another thing that we have heard about acid rain is its effect on the trout and its effect on recreation and tourism, but one of the things that we have in New Hampshire is one of the only departments that actually makes money in New Hampshire that it can give to the State to support the State is the Fish and Game Department.

But also you have taxes on gasoline, and you wouldn't have as many people buying gasoline if they didn't come to the State to fish. They wouldn't be paying tolls. There are taxes on hotel rooms in New Hampshire. There are taxes on fish and game licenses in New Hampshire. There are taxes on restaurant food in New Hampshire. We would lose money from a thousand different ways and then be on your doorstep begging for financial aid to the Federal Government like Chrysler did when they were going down the tubes.

It simply doesn't make any sense to save money now and 10 years down the road—and that is probably all it is going to be, 10 years down the road—have to read out to Chrysler situation and then have the Government and industry react severely in that point.

If this is any help at all with your methods of dealing with some business-oriented people, the Lung Association would be happy to come up with any kind of cost-effective sheets, should you need them. With the temper of the time in Washington, we want to thank you for your interest and fortitude of being here today. Thank you very much.

Senator **STAFFORD**. Thank you.

Joan Stevens will be followed by Garth Wade.

STATEMENT OF JOAN STEVENS, NEW HAMPSHIRE CITIZENS TASK FORCE ON ACID RAIN

Ms. **STEVENS**. I am here representing the New Hampshire Citizens Task Force on Acid Rain which is a coalition of individuals and organizations with combined memberships of well over 10,000 New Hampshire residents, all concerned about the impact of acid rain on human health and on the region's aquatic and terrestrial ecosystems. The task force was organized to launch a coordinated effort to increase public awareness about the causes and effects of acid rain, and to recreate public support of legislation and administrative programs directed at alleviating this problem.

We believe that the most immediate and effective solution available is the enactment of a strong Clean Air Act. Acid rain is an acute symptom of the many problems associated with air pollution. We believe that enough evidence is available concerning the cause and effects of acid rain to know that we can spare no time in effecting solutions to the problem.

Results from recent studies in the Ohio River Valley confirms the fact that sulfate deposition is a threat to human health in the Midwest, as well as in the Northeast. We strongly support the reauthorization of the Clean Air Act, and urge the committee to address the issue of the long-range transport of air pollution during the reauthorization process.

Thank you for this opportunity to comment.

Senator **STAFFORD**. Thank you very much, Ms. Stevens.

We now recognize somebody, but I couldn't hear who. Mr. Wade? Oh, yes, Mr. Wade is from New Hampshire, also, I believe.

He will be followed by Anne Baker of the Lake Champlain Committee.

STATEMENT OF GARTH WADE, NEW HAMPSHIRE LUNG ASSOCIATION, MEMBER, AIR RESOURCES COMMISSION

Mr. **WADE**. My name is Garth Wade. I am with the New Hampshire Lung Association, but I would like to speak from my position as a member of the air resources commission with the State of New Hampshire.

There is a little indication that I can detect among my fellow commissioners and in New Hampshire to allow any weakness of the State regulations, even if the Clean Air Act were, in any way, weakened. But if the act were weakened, it puts the commission's job in a more difficult light. It gets hotter in the kitchen, so to speak, without the backup of Federal law.

The other question that comes up in connection with that is that it may put the industrial development departments of the various States into greater competition with one another vying for new business by way of more lax laws in this State versus that State.

You asked a little earlier if the—in the afternoon session—if there was one amendment that you could recommend for the Clean Air Act.

If I may take the liberty of offering one, I would outlaw tall stacks totally.

I think EPA went right off its rocker when they got onto that caper.

You will hear some comments from industry, I am sure, arguing against some of the complications of the act, and I think without in any way jeopardizing the substance of the act, there is room for tidying up some of the wording here and there. In some places it is utterly confusing.

Another point that I would like to make in dealing with the—certainly, from the EPA end of things, EPA has a tendency to wander off and start dictating methods when I think their more proper function is to concentrate on the end results required.

You will also hear, I am sure, of some testimony offered by industry that foreign competition coming from countries that have less stringent air regulations is something of a threat. I think rather than relax the American regulations to match that, we ought to use our influence as a nation to try and promote better regulations in the foreign countries.

I think in that connection we might take a look at the tariff regulations and the antidumping laws to see if there is any room for leverage in that direction.

Thank you.

Senator **Stafford**. Thank you very much, Mr. Wade.

Anne Baker of Lake Champlain Committee, followed by Roald Cann, who will be next after Anne Baker.

STATEMENT OF ANNE K. BAKER, LAKE CHAMPLAIN COMMITTEE

Ms. **Baker**. My name is Anne Baker. I am the executive director of the Lake Champlain Committee based in Burlington, Vt., a citizen's conservation organization founded in 1963 with 1,300 members from New York, Vermont, and Canada, and across the United States.

Since our concern is the air, land, and water quality and people living in the Lake Champlain Basin, the hydrological basin, 8,234 square miles covering parts of New York and Canada, we are acutely aware that some 300 lakes in the Adirondack Mountains are devoid of fish due to acid rain of the Adirondack Lakes within the Lake Champlain Basin, some 20 lakes were surveyed and 4 were in the endangered category with a pH of 6 or below; that acid snow may be at least as damaging to Adirondack lakes as acid rain, since acidic water from melting snow rushes directly into lakes, substantially increasing acidity in short periods of time; information gleaned from the University of Vermont's research under the direction of Dr. Hub Vogelmann and Dr. Richard Klein is strongly suggestive of a cause-and-effect relationship with regard to the 50-percent mortality of red spruce at higher elevations in Vermont; the Hubbard Brook studies in 1974 found and documented a slowdown in growth of trees in the hardwood forest.

Doctors Vogelmann and Klein are picking up the same things in their studies.

The Lake Champlain Committee has committed budget funds to study the problem of acid rain and has contributed support to finding the answers.

We know that acid rain has been around since the start of the industrial revolution; however, the problem was then localized because industrial smokestacks were shorter, thus dispersing sulfuric acid and soot particles in a small radius around the industry.

Since the advent of high stacks, the problem has been transported into the atmosphere and carried around the globe to rain on unsuspecting natural areas and people.

We know that fish and their habits have been affected, but we do not know with any degree of accuracy the effect on wildlife because little research has been done except that they are in the food chain, and that deer may accumulate heavy metals from the vegetation they eat. Heavy metals are ancillary to the acid rain and can be toxic to the animals ingesting them.

Soils can also be affected by acid rain, losing productivity by erosion and carrying trace elements and heavy metals into streams, lakes, springs, and municipal reservoirs damaging drinking water supplies.

It is here that people can experience the insidious effects of acid rain. The sulfuric and nitric acids in acid rain corrode copper and lead pipes used in drinking water systems. These corrosive materials are highly toxic metals which may reach levels unfit for human consumption.

This indirect human effect of acid rain has occurred in the Adirondacks and in Scandinavia.

Though effects of acid rain to wildlife and people have not yet taken a visible toll and because such effects can be very long-term, as much as 25 to 30 years, it is exceedingly important that our air pollution laws remain stringent for the health of our population today and for future generations.

The Lake Champlain Committee strongly supports maintaining a strong Clean Air Act by placing stricter control on toxic pollutants such as asbestos, beryllium, mercury, and vinyl chloride and regulating long-range transportation of sulfur dioxide and sulfuric acid.

There is a question of economic and environmental equity when the States of New York and Vermont have spent thousands of dollars to clean up its water and air, and from beyond our borders comes something that we cannot control. It is a problem of national proportions, magnitude on a regional basis.

Thank you, Senator Stafford.

Senator STAFFORD. Thank you, Ms. Baker.

Mr. Roald Cann will be followed by Dr. Weatherhead.

STATEMENT OF ROALD CANN, WETHERSFIELD, N.H.

Mr. CANN. Thank you, Senator Stafford. I represent myself and live in Wethersfield.

I have nothing against industry. In fact, I work at one of the machine tool companies in Springfield as an engineering supervisor, and I own a few shares of stock of various industrial concerns, so my income depends on the health of industry.

Nevertheless, I am convinced that we should be very skeptical about industry's crisis about too costly a burden of air quality protection.

Industry does not really end up paying the extra cost, since it is passed on to the consumers. I think that we, the consumers, are willing to pay reasonable costs of the air quality protection in the prices of products we buy. If the extra cost seems unreasonable to us, we will stop buying that particular product, which will cause it to stop being produced, which also protects the air quality.

Many of us would rather pay the extra financial cost than pay the moral cost of knowing that we are causing great harm to the health of others, including our children and their children.

Certainly, if the manufacturing of a boiler required that one man be left inside each boiler to back up the rivets during manufacturing, no one would buy such a boiler even if the financial cost were reasonable.

So long as all competitors have to play the game according to the same rules, no business is hurt. The great American system of competition will exert positive feedback by rewarding those companies which find better ways to purify their waste air, including useful products out of the catured wastes; or replacing the product with another one whose manufacturing causes less harmful wastes.

Competition from countries which have less strict air quality standards can be made more fair by imposing an import duty approximately equal to the average cost of air quality protection included in the prices of American products of that type.

Cost-benefit analysis is distasteful when it implies placing a dollar law on human life or health. Yet I recognize that there must be a way of defining what level of air quality is good enough.

I suggest that a reasonable direction to follow is to consider that manmade pollution levels might be allowed to equal natural pollution levels in the same area and that statistical health risks due to manmade pollution might be allowed to equal the risks we currently take in our daily lives.

I know this is greatly oversimplified since different people take different risks and since natural pollution can be quite bad in such places as near an active volcano.

There will have to be political decisions made with the help of scientific experts who do not even agree with each other.

One more point, there is considerable evidence that agriculture in the West and Midwest will decrease dramatically in about 20 years because of depletion of ground water. Water tables are dropping rapidly. Water which was stored over the course of thousands of years is being consumed at very rapid rates. If this does happen, the Eastern United States will have to supply much food and fiber.

If acid precipitation has by then made Eastern land unsuitable for agriculture, we will be in a real pickel, no pun intended.

Thank you.

Senator **Stafford**. Thank you, Mr. Cann.

We will have to recognize you in just a second.

I think in view of the hour, if you will let me have just a minute, Doctor, that I will indicate that the people who have, additionally to the doctor, asked to be recognized, that we are going to close the list with these names that I am going to read. When they are done, we will close the hearing.

Following the doctor will be Susan Alden and then Joe Allen Mulvaney, and following disposition of those speeches, will be Martha Solow, of Common Cause, followed by John Hird, and Henry Ross will be the final speaker this evening.

My apologies, Doctor, but I thought we had better get this on the table.

Now you are ready.

STATEMENT OF DR. WETHERHEAD

Dr. **Wetherhead**. Thank you very much, Senator Stafford, and ladies and gentlemen.

I am going to take a different approach than has been so far voiced tonight, although I am in complete accord with everything that has been said.

I am glad to think here that so many people are for nice, fresh air. There are knowledgeable people who say our energy crisis is a political crisis or our energy crisis is political and not technical.

The Christian Science Monitor reports, "A study commissioned by the Department of Energy but never released claims 5⁹⁄₁₀ million barrels of oil a day, equal to today's imports, can be saved by conservation." This means that 5¹⁄₁₀ million barrels of oil that wouldn't be burned to pollute our air.

Last fall Vermont received a report on an energy audit done for them on 119 State-owned buildings which said, "If properly weatherized, approximately $700,000 a year could be saved." At $1.25 a gallon, this would mean 560,000 gallons of oil that would not be burned to pollute our air

In the winter of 1973–74, Vermont burned about 175 to 177 million gallons of oil for home heating. Recently, it was estimated that is now down to about 125 or 130 million.

Our energy department people feel it could easily be reduced another 30 percent, at least.

This means, based on the 125 million figure, another 37½ million gallons of oil could go unburned and still keep everyone comfortable as we are now.

The National Academy of Sciences says it is now a better investment to save a Btu than to produce one, which is why the Canadian Government has allotted $1.4 billion to help their citizens weatherize their homes. It is my understanding that they, the Government, will pay one-half of the individual's cost.

Last fall, an experimental furnace was put in my basement. It is a combination oil and electric unit. Oil heats the house during the 7 expensive peak hours, and electricity for 17 of the off-peak hours. Because of this, there is a different, less expensive rate.

Last winter, the winter of 1980-81, from October 24 to March 24, I used 172 gallons of oil.

This is a 7-room house with an average cost, to me, at that time, of $1.15. The total cost of electricity and the oil together was $436.

The point for today is that my home, 17 hours out of every 24, was not polluting the air, aside from the fact that it almost cut my heating costs in half.

Governor Snelling's plan to bring Canadian electricity in could possibly mean, in the light of these new heating units and others, that in time, almost every home in Vermont could feasibly be heated, at least in part, by this nonpolluting source of energy. Our air would be that much cleaner; our balance of payments improved; our dependence on foreign oil possibly reduced to zero, or the chance of going to war for oil in the Middle East, as General Haig indicated, we might if necessary, would be eliminated.

Because of these points I have mentioned, and many others, too, involved for today, I want to say that I personally feel quite strongly that our Federal Government is not really concerned about the various factors covered under the euphemism of energy crisis. It is not willing to face the problem in its totality; nor have the courage to develop a plan which would have to be massive, but predictably successful to accomplish the task.

The Reagan administration wants to slash conservation programs already in place 78 percent; renewable energy programs, 67 percent; and yet you, yourself, Senator Stafford, recently said you feel they, the Government, are asking for too much money too fast for defense proposed right now; that we could have "two flat tops, possibly, for less than the price of one big one, for example."

I ask, what is more defensive than eliminating our dependence on foreign oil?

Fear seems to have driven America to magnificent accomplishments: Our trip to the Moon, the Manhattan project; the Marshall plan; the Berlin airlift; the Normandy invasion, and so forth. Shouldn't fear of a war in the Middle East be an equal reason for a massive plan that would get rid of all foreign oil and at the same time clean our air thoroughly? To me, the maddening part about this is that there is no real technical problem. It is all feasible. It is all possible. All we have to do is do it.

Thank you, Senator.

Senator **Stafford**. Thank you.

Is Suanne Alden present?

STATEMENT OF SUANNE ALDEN, BURLINGTON, VT.

Mrs. **Alden**. Yes, Senator Stafford. I am Suanne Alden, speaking for myself and my husband, Peter. We live in Burlington, Vt.

We wish to see the Clean Air Act reauthorized and strengthened, not weakened. It is not fair to the States that have complied to let industry in other States delay or ignore necessary cleanup procedures.

We believe in a balanced budget. We have to do it in our own families. We must pass the costs of compliance and enforcement on to the consumer. If we don't pay this increase in the cost of manufactured goods or energy, we will end up paying for polluting, as we do now, with increased health and hospital costs; damage to buildings, crops, vegetation, water, and so on.

We must preserve air and water that is already clean. While in Utah last spring, I toured the world's biggest open pit copper mine, then rode by its three or four smelting plants. When I inquired about compliance with air pollution controls, the tour guide said, and I quote, "Well, they built the stack high enough so none of the gas comes down here. It goes well beyond our State."

This type of pollution must be controlled at the source without the delays granted earlier by the Clean Air Act in 1977. Little did the guide know or care that this tall stack practice is the cause of our acid rain problems in the East.

We need healthy forests as never before as we turn from costly petrochemicals. Healthy woods clean the air of excess CO_2. Here in Vermont, wood is a renewable resource, a means of heating homes for more than half the year; used for building and paper products and hundreds of other uses.

We are also concerned about the regulation of toxic pollutants and that of fine particles. Their synergistic or compounding effects of even low levels of multiple pollutants must be considered and acted upon.

There should be no further delay in final emission standards for the growing number of diesel vehicles. Lungs are injured by these finer particles which are coated with thousands of polluting toxic chemicals.

We thank you for your long interest in the environment and for listening to us here in Vermont.

Senator STAFFORD. Thank you very much, Su.

The Chair will next recognize Joe Allen Mulvaney. Joe Allen, we are puzzled here. Would you straighten us out? Are you speaking for yourself or for Ed Stevens or Joseph Grant, or are you speaking for yourself?

Mr. MULVANEY. I am speaking for myself. Ed can speak for himself. In fact, he is going to send you something in the mail.

Senator STAFFORD. We will keep the record open so that can be done.

STATEMENT OF JOE ALLEN MULVANEY, WASHINGTON, VT.

Mr. MULVANEY. Thank you. First of all, thank you for coming to talk to us about acid rain. I am from Washington, Vt., which is—my house is within sight of Rocky State Forest. From something there, I read recently in the newspaper, Grout State Forest is probably a place that is going to be very badly affected by acid rain—not probably—it is.

We have been talking about wood as a source of heating for Vermont. Many of us do use wood. Acid rain is one thing that will kill the trees. If we don't have the trees, we don't have the wood.

Before moving to Vermont, I lived in Burlington, N.Y., for 8 years. The last 2 years of my stay there, I could not go out in the rain without getting stingy eyes. My children, however, were born in Vermont. They are native Vermonters.

I would not like to see them have to wear eye protectors to have to walk in the rain as they are growing up and as they get older. I am very concerned about the children of this State, about their children, and about the health of the entire country.

Actually, a lot of us in Vermont tend to think that our borders are very strong and that we are not affected by the pollution of the other areas. I prefer to think of myself not only as a Vermonter, but as an American, and I am concerned not just for my State and my family, but for all the families and all the other States in the Union.

I hope that it is true that Washington can do something for us, for the entire country; and I hope you take our message to them.

Thank you.

Senator **Stafford**. Thank you very much. The Chair is still uncertain. Is there someone who will give us a statement from Mr. Joseph Grant? If not, we will keep the record open in the event Mr. Grant wants to give a statement.

We will recognize Martha Solow of Common Cause. She will be followed by John Hird of Lower Waterford.

STATEMENT OF MARTHA SOLOW, COMMON CAUSE

Ms. **Solow**. Thank you, Mr. Chairman. I represent Common Cause of New Hampshire and Vermont. We have over 850 members in Vermont and approximately 1,350 members in New Hampshire. I suspect that the views of the organizations members in these two States are very much reflected by the national consensus.

A number of speakers preceding me have made many points that I would have made. Out of respect for your patience and the hour, I will be brief, but there are a few points I would like to underscore.

No. 1, there is a national consensus in favor of strengthening and at least maintaining the standards we now have to prevent pollution and to maintain good air quality.

Second, there are costs associated with maintaining good air quality, and these, if they are not won by our generation, will be won by future generations. There is no way of escaping those costs.

People nationwide have expressed enthusiasm and willingness for paying those costs.

Lastly, the point I think I would underscore most highly is this is, without a doubt, a national issue and should be solved on a national level. I am a resident of the State of New Hampshire.

The prospect of the State of New Hampshire being given the powers of enforcement is somewhat frightening. We have neither the personnel nor the budget resources to do that sort of thing. We commend you for bringing your hearing to this area so that the citizens can express their views.

Thank you again for your patience and the opportunity to speak.

Senator **Stafford**. Thank you very much.

I hope I haven't mispronounced your name: Hird?

Mr. **Hird**. It is perfectly clear that Hird is not the household word in Vermont. The Hird names are Welshmen and are Hird but H-i-r-d is a perfectly good English name.

Senator **Stafford**. You will be followed by Henry Ross, the last speaker.

STATEMENT OF JOHN HIRD, LOWER WATERFORD, VT.

Mr. **Hird**. I am a member of the bar in Vermont, but I have no idea of burdening this session with noises that come from legal lips. I speak strictly as an asthmatic since the age of 3.

I must walk about or have in the house medication all the time. What I need for this evening, I happen to have in my hand right now. Unfortunately, I have blessed a daughter who is a business woman in Minusky with the same problem.

I wished I hadn't, but that is the way it is. Consequently my interest in this subject is entirely personal, and I wish to dramatize it by complaining that when I escaped from Massachusetts 6 years ago and came north here, I had no idea. I was repeating in reverse the history of the unfortunate gentleman who had a farm near Manassas Junction in Virginia when the first battle of Bull Run was fought.

If you recall your history, the peace treaty at Appomattox was signed on the farm to which he had retired in Manassas 4 years later. I trust that Lower Waterford, Vt., is not going to repeat that particular bit of history, and I rely upon you, sir, to do your best to see that it does not happen.

One other thing: This cost-benefit business confuses the devil out of me. The cost that they are talking about is, if I am not mistaken, the repair of the damage they created, and if that is so, then it seems to me that we have an argument that starts with a problem which needs to be taken back still further, and thus to determine whether these people who have created these problems that come wafting from Marcus Hanna's old jurisdiction this way ought not to correct and bring up to parity before we then start talking about the cost of the benefits.

Thank you very much.

Senator **Stafford**. Thank you very much, Mr. Hird.

The final speaker tonight will be Mr. Henry Ross, speaking for himself if he wishes; also with the Federation of Sportsmen's Clubs.

STATEMENT OF HENRY ROSS, FEDERATION OF SPORTSMEN'S CLUBS

Mr. Ross. Senator, I am Henry (Hank) Ross. I am a local boy. I couldn't resist an opportunity to speak to a somewhat captive audience. I graduated here back in the early 1930's. I spent later, 12 years in Haugerty, so this is kind of a second home.

I am very proud that you decided to make Randolph Center the place for this hearing.

I will say that hearing that matter, we have been blasted in the ear by a lot of clean air. Sometimes it is quite cold, and I have known times when it was rather warm.

I am speaking as president of the Federation of Sportsmen's Clubs in Vermont, an office I have held for several years. This is a group of 30-odd sportsmen clubs throughout the State that are interested in fostering anything that has to do with the betterment of hunting, fishing, trapping, and also anything that has to do with the State of Vermont and as an end result, for the betterment of all Vermonters.

We have not discussed in the Federation the Clean Air Act per se. We have taken stands on the wilderness area, which they testified to. They have taken stands on the various bills, and so forth, but I feel that I can speak for the Federation and myself in favor of the Clean Air Act.

Back when it was less than one person per square mile, this wasn't too much concern, but things have a way of changing which brings about a different situation.

I originally was opposed to the zoning, but I have had to change that. I think this Clean Air Act would be compared quite favorably with zoning. Zoning is concerned with two dimensions: Length and width. Clean air three dimensions: Length, width, height, and if you are not familiar with the fourth dimension, time.

So I would like to go on record as saying that we need the Clean Air Act. Primarily, I mean, I think I am a Vermonter. I date back to Ethan Allen. My roots were here before Vermont was a State. I am also told that I have some Indian blood, so I am thinking that is coming out of Vermont.

I have been for States rights and not too happy about federalism, but just like zoning, I believe that we have come to a point where we have got to have some Federal control. I think that the Clean Air Act might be one of those things.

So I wish to thank you for coming. I wish to thank you for allowing me to speak, and I hope that we can go forward in the right direction. Thank you.

Senator STAFFORD. Thank you very much, Mr. Ross. We are about to close the hearings, but I have a couple of announcements before we do.

First of all, I want to thank all of you for coming out here and for all of you who have testified here tonight and those of you who sat through the hearings during the day. As a matter of fact, I would like to—I stress the word like—to make what has been said here tonight required reading for all the members on Environment and Public Works.

We are going to hold the record open for 10 days so that if any of you wish to submit a short written statement for the record, additional to the comments that were made tonight, you can do so by sending it either to me at my Burlington office, which is in the Federal Building in Burlington, or directly to the Committee on Environment and Public Works in the Dirksen Building, U.S. Senate, Washington, D.C.

It has been relatively easy for me as the presiding officer today to sit here and try to keep things moving, but the people who really did all the work to set up this meeting for me and for you are the professional staff members from our committee who made the arrangements and came up here and have to be in Albany, N.Y., tomorrow morning to hold a similar hearing for Senator Moynihan in that State.

So I want the record especially to show my gratitude, and I think, it should show yours too, to Curtis Moore, Cathy Cudlipp, and Sharlene Sturbitts, who is at the other table next to us, who helped make all of the arrangements and the girl who has recorded everything that we have said today: Good, bad, and indifferent, really worked an unusual number of hours, it is our reporter LuAnne Dawson.

She will be thankful enough to hear me say that the meeting of the committee is adjourned.

[Whereupon, at 9:30 p.m., the committee recessed, to reconvene subject to the call of the Chair.]

[Statements submitted for the record follow:]

STATEMENT OF
DENNIS TIRPAK
DIRECTOR, OFFICE OF EXPLORATORY RESEARCH
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
BEFORE THE
COMMITTEE ON ENVIRONMENT
AND PUBLIC WORKS
UNITED STATES SENATE

June 30, 1981

Good afternoon, Mr. Chairman, I am Dennis Tirpak, Director of the Office of Exploratory Research in EPA's Office of Research and Development (ORD). With me today is Lowell Smith, Director of our Program Integration and Policy Staff. My responsibilities include coordination of EPA's research efforts on acid precipitation and integration of these efforts with ongoing efforts on criteria pollutants. I also work closely with the Federal government's Acid Precipitation Task Force, which I shall discuss later. I have been involved with this EPA program for nearly three years. In that time I have had extensive dealings on acid precipitation with experts from this country and others. I am pleased to appear before you today to discuss the current research work of EPA, as well as joint U.S.-Canadian research activities. First, I shall briefly discuss the significant forms of air pollutants. Second, I shall discuss some of the effects of these pollutants. Third, I shall discuss the status of U.S.-Canadian activities related to long range transport of air pollutants. Finally, I shall discuss EPA's research activities on oxidants and acid precipitation.

The Atmospheric Pollutants

Ozone is one of several photochemical oxidants which is produced mainly through the interaction among volatile organic hydrocarbons and NOx emissions produced by human activities and natural sources.

Sulfates are negatively charged aerosol components that are oxidation products of sulfur dioxide. They are not found alone in the atmosphere. Instead, they combine with positively charged species to form compounds of the "sulfate family", such as ammonium sulfate and sulfuric acid.

"Acid rain" is understood to mean the deposition of acidic materials, whether wet or dry, from the atmosphere onto the surface of the earth and upon structures and objects (whether natural or manmade.) For precipitation to be considered "acidic," the material deposited must have an acidity greater than that for carbon dioxide-saturated water (i.e., pH less than 5.6).

The Effects of Ozone and Sulfates

Because of the importance of agriculture to the American economy, we have looked at the effects of acid precipitation and ozone on a wide range of crops. Our document, Air Quality Criteria for Ozone and Other Photochemical Oxidants, indicates the complexity of ozone impacts upon crops. Ozone is considered to be toxic to some plants at certain levels of exposure, but scientists continue to disagree on the length and duration of exposures which cause injuries.

The most visible plant injuries are usually lesions, flecks, or stipples on leaf upper surfaces. A number of crops such as beans, wheat, alfalfa, soybean, and radishes have shown injuries from exposure to ozone within the range of ozone oxidant levels which have occurred in eastern United States.

With respect to forest growth, ozone could be partially responsible for reduced growth of Ponderosa and Jeffrey pine in the San Bernardino Mountains of southern California. Growth suppression makes these tree species especially susceptible to the impacts of bark beetles and to fungal pathogens, as well. In the Southeast, the White pine suffers foliage discoloration and changes in productivity, and this southern coniferous forest ecosystem has developed patterns of pine replacement by oak and cedar.

In the area of health effects of ozone, there is considerable room for honest disagreement on whether pollution-induced alterations in mechanical lung function constitute bona fide impairments of health in and of themselves. In the great majority of experimental studies in which oxidant exposures have produced changes in lung function in healthy subjects, function has returned to normal within a few hours. Thus there is no reason to suspect that in healthy individuals such changes promote any measurable increase in risk of future illness. Nor does any available evidence suggest that in healthy individuals a small change in ventilatory function, unaccompanied by symptoms or impairment of oxygen uptake or work capacity, would interfere with normal activity or task performance.

However, considerations suggest that oxidant-associated changes in lung function may signal impairment of health. First in persons with underlying respiratory illness such as asthma, chronic bronchitis, and emphysema, even small decrements in lung function often interfere with normal activity. Second, at experimental ozone concentrations as low as 0.30 ppm, decrements in lung function have usually been accompanied by physical discomfort, as manifested in symptoms such as sore throat, chest pain, cough, and headache. Thus, at least when associated with ozone exposure, changes in lung function can potentially induce a level of discomfort that, even among healthy people, may temporarily restrict normal activity or impair the performance of tasks. For a more complete discussion of these effects, I would refer you to the previously referenced Criteria Document.

With regard to SO_2, the Agency is currently reevaluating the available scientific information on human health effects. An important issue is what levels would symptomatic and functional responses occur under free breathing conditions in asthmatics. We are awaiting the results of additional studies aimed at addressing this issue.

Effects of Acid Precipitation

We suspect that the potential effects on our welfare caused by deposited acid materials may include: impacts on man-made materials; impacts on high elevation lakes and headwater streams; impacts on crops; impacts on our forests and other natural ecosystems; and impacts on certain soil systems.

It was not far from here in the Adirondack Mountains of New York State that the acidification of a large number of U.S. lakes was first documented. Here in Vermont, the state has undertaken an extensive survey of its lake resources and has initiated a longer-term, continuing chemical study of about 25 lakes and biological survey of a smaller number. Neighboring New Hampshire has recently surveyed several of the 26 alpine lakes for which water quality data exist from 30 to 40 years ago and has proposed additional studies.

The acidification of lakes and watersheds results in mobilization of metals from the soils, minerals, or sediments into the waters. This mobilization of metals and low pH waters create toxic conditions for various fish life stages. For game fish, mobilization of inorganic aluminum has proven to be toxic to Brook Trout fry below pH 5.5.

However, acid precipitation is a problem in need of additional research, before it can be adequately understood and addressed in a policy context. We do not have a good long term monitoring data set such as is available in Scandinavia. We do not know the role NO_x plays in the formation of acid in the atmosphere. While we do have a number of air transport models, which are being verified, for predicting the transport and deposition of sulfates, we do not have a model for predicting deposition of nitrates. Neither for sulfates nor nitrates do we have adequate models for identifying specific sources which may ultimately have to be controlled. Many of the atmospheric chemical reactions and the various rates which govern the formation of nitric acid in the atmosphere are unknown. We do not know precisely how rapidly our lake systems will decrease in pH.

In the testimony to this point I have discussed the potential impacts of the interstate air pollution problem. Mr. Smith will discuss the modeling tools that are needed to relate the sources to the pollutant receptors. I would now like to describe United States--Canadian activities and the research and assessment activities organized to provide new information necessary to understand and deal with the problem.

U.S.-Canadian Transboundary Air Pollution Activities

The Canadians have for some time been concerned about air pollution and its effects, particularly the effects of long range transport and acid deposition in their country. The Canadians are both exporters and recipients of the emissions which can contribute to acid deposition. They have joined the mutual effort to seek ways to reduce the emission levels of suspected acid precipitation precursors within their borders.

On August 5, 1980, the United States and Canada signed a Memorandum of Intent (MOI) in which the two countries agreed to study jointly the issues of transboundary air pollution and to begin to negotiate a treaty to deal with this issue. We began formal negotiations on this issue on June 23. The MOI clearly states that any negotiated treaty must address both short-range and long-range pollution transport, as well as other pollutant types, besides acid precipitation precursors.

Within this MOI framework, five Work Groups have been created to prepare the needed technical reports and scientific analyses. The Work Groups are addressing the following aspects of the transboundary air pollution problem: assessment of the impact of pollutant concentration and deposition; analysis of atmospheric chemistry and transport models to determine relationships between sources, the processes of transformation, and receptor areas; refinement of emissions inventories in both countries; and development of alternative approaches for mitigation efforts. The Work Groups are comprised of representatives from the Departments of State, Agriculture, Interior, Energy, EPA, the Council on Environmental Quality, the National Oceanic and Atmospheric Administration, and other agencies as well as representatives from corresponding Canadian departments.

Research Activities

EPA's acid precipitation research is conducted under a multi-agency Federal program that I will briefly discuss. I also wish to emphasize that other agencies, particularly the U.S. Forest Service and other entities of the U.S. Department of Agriculture, conduct oxidant research, and that there is significant interagency planning and support.

Oxidants Research

The Environmental Protection Agency's Oxidants Research Program is in direct support of the Clean Air Act and its 1977 amendments. Major research themes are: preparation of criteria documents for ozone and nitrogen dioxide National Ambient Air Quality Standards; research to support criteria for ozone, nitrogen oxides and other products of atmospheric photochemical reactions, focussing on their health and welfare effects; development and validation of models to support State Implementation Plans for ozone and nitrogen oxides; development of control technologies for volatile organic compounds and nitrogen oxides in support of both State Implementation Plans and the New Source Performance Standards program; and development of validated models and effective NO_x control technology to eliminate the contribution of nitrogen oxides to "plume blight" visibility problems. In fiscal year 1981 the oxidants research program is supported at a level of approximately twenty-four million dollars. I will now highlight a few of the major oxidant research efforts:

We are attempting to reduce the uncertainty in estimates of risks to public health with both human-clinical and animal-biological research.

We are developing scientific knowledge to assess the impacts of ozone on agriculture, forestry, and recreational resources. We are developing a nationwide data base to assess the impact of ozone on the yield of major agriculture crops on five research sites covering four geographical regions. These sites are located in New York, Maryland, North Carolina, Illinois and California.

We are conducting research and developing monitoring and quality assurance information to be provided to the states in support of their efforts to reach State Implementation Plan goals. We are also developing urban ozone/oxidant air quality models and regional scale ozone air quality simulations. These models consider both manmade and biogenic sources of oxidants.

We are evaluating control technologies for volatile organic compounds, precursors of oxidants in the atmosphere, for both State Implementation Plan and New Source Performance Standard support.

Federal Acid Precipitation Program

There is also a substantial commitment to research on acid precipitation in the FY 82 budget. Of the $20 million proposed for all Federal acid precipitation research, $9 million is for EPA's activities in aquatic and terrestrial effects, emission control technology evaluation, monitoring, and assessments.

The Interagency Task Force mandated in the Acid Precipitation Act of 1980 has prepared a draft Acid Rain Assessment Plan. As co-chair of this Task Force with USDA and NOAA, EPA has participated in producing an integrated research program and has taken the lead in three of the nine technical "Task Groups", specifically in the research areas of Aquatic Impacts, Control Technology, and Assessments and Policy Analysis. More than eight Federal agencies are currently involved in this effort.

EPA Acid Precipitation Research

The scope of EPA acid precipitation research activities includes studies of aquatic and terrestrial effects; atmospheric transport and transformation processes; assessments and mitigation strategies; and the evaluation of potential control technologies. Limited scoping studies on impacts on drinking water and materials are underway. Precipitation monitoring efforts are conducted in support of the interagency program. This broad scope has been attained by expansion and redirection of research programs to allow EPA to fulfill its responsibilities as one of the lead agencies under the draft Interagency plan. We have given a high priority to assessing currently available research information and identifying and filling gaps in knowledge. We are, for example, surveying the extent of acidification of lakes by acid precipitation in the mid-Atlantic, New England, and upper Midwestern States. Interim results have been published on Minnesota/Wisconsin lake systems. These surveys and others are attempting to determine the relationship between acid deposition and water quality trends. Projects are also being undertaken in cooperation with the U.S. Fish and Wildlife Service.

EPA is using a scientific peer system to guide and review ecological research through a Cooperative Agreement with North Carolina State University on Effects of Acid Precipitation on Aquatic and Terrestrial Ecosystems. The agreement has completed its first year, and funded 16 research projects across the country. Scientists from Canada and Scandinavia are participants in this program.

We have looked at the effects of acid rain on a wide range of crops. Our Corvallis, Oregon, laboratory has conducted studies on the impacts of simulated acid precipitation on 28 crop species. We also support crop studies at the National Energy Labs. Current studies are aimed at surveying all major economic crops. More detailed studies may be conducted on crops that show adverse effects. The Department of Agriculture is the lead agency responsible for research on terrestrial effects of acid precipitation.

Efforts to upgrade interagency monitoring activities have continued and include the development of quality assurance protocols and an Acid Deposition Monitoring Data Bank. Monitoring data from all major U.S. and Canadian monitoring networks are being compiled by EPA. Several remote acid precipitation baseline sites in Australia, Venezuela, Alaska, Bermuda and Amsterdam Island were established in cooperation with NOAA. These sites were established to determine whether acid rains take place in remote regions. In conducting these projects, we are working closely with the U.S. Geological Survey which is the lead agency responsible for interagency monitoring activites.

EPA is also working to coordinate research with major private sector programs and with the states. A recent example was the March, 1981, workshop involving EPA and Electric Power Research Institute (EPRI) supported researchers and managers of projects in ecological effects.

This concludes my prepared statement on interstate air pollution and EPA's research efforts. Following Mr. Smith's statement, I would be happy to respond to any questions you have regarding our research program.

STATEMENT OF
LOWELL SMITH
DIRECTOR, PROGRAM INTEGRATION AND POLICY STAFF
OFFICE OF RESEARCH AND DEVELOPMENT
UNITED STATES ENVIRONMENT PROTECTION AGENCY
BEFORE THE
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

JUNE 30, 1981

Good afternoon, Mr. Chairman. I am Lowell Smith, Director of the Program Integration and Policy Staff of EPA's Office of Research and Development. For the past six years I have been responsible for research programs that, along with other goals, have been aimed at identifying the nature and extent of regional air pollution problems, and analyzing the relative efficacy of alternative policy options to deal with these. By regional air pollution problems, I mean those situations of a non-local nature that extend across state or international boundaries, particularly where a principal source region might lie in one or more contiguous states upwind of potentially affected areas. I am responsible for managing segments of the National Acid Precipitation Assessment Program and serve as the U.S. Vice-chairman of the Atmospheric Sciences and Analysis MOI Work Group* and as the U.S. Chairman of the Strategy Development and Implementation MOI Work Group*.

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* Established under the terms of reference contained in the Memorandum of Irtent on Transboundary Air Pollution (MOI) signed on August 5, 1980, between the Government of the United States and the Government of Canada.

INTRODUCTION TO THE PROBLEM

It takes no sophisticated analysis to recognize that pollutants can be carried in air masses across state boundaries to cause interstate air pollution.

For purposes of analysis, transport of pollutants can be categorized as occurring over three distances:

- Local - up to a maximum of 50 km from a source;
- Medium range - covering areas of about 50 km to 300 km in extent; and
- Long range - covering regions of about 300 km to 2000 km in extent.

Measured pollutant concentrations are the cumulative impact of these local, medium and long-range effects.

The most obvious and best documented examples of interstate pollution occur on the local scale where individual sources located just across a border cause high ambient pollutant concentrations in a downwind state. These situations can be analyzed through use of conventional monitoring studies and Gaussian plume modeling techniques. There is no essential difference in the application of these technical tools in moving from intra to interstate air quality problems.

Several areas in the U.S. which contain a large number of emission sources are subject to medium-range air quality management problems. When several major sources are located along the direction of prevailing wind flow, the background air pollution concentrations in downwind areas can be strongly influenced by the upwind sources.

Major river valleys tend to channel prevailing winds and as these rivers often form the boundaries between states, air quality management can become an interstate matter.

I do not intend to dwell on local or medium-scale interstate transport problems. Rather, I intend to confine my remarks to the interstate pollution caused by the long-range transport of emissions.

It is well documented that emissions from a number of sources can accumulate in an air mass and travel long distances to cause interstate pollution. Such emissions may contribute to interstate air pollution in two ways: by increasing ambient air pollution concentrations and by depositing pollutants out of the atmosphere either dry as gases and particles or in all forms of precipitation. In the first case, adverse effects can derive from elevated air pollution concentrations and decreased visibility. In the second instance, damage could possibly result from dry and wet deposition of acidic compounds, heavy metals, and toxic organic substances.

I will describe briefly what is known about: (1) the principal emission sectors which contribute to interstate air pollution (excluding natural emission sources), and their geographical distribution; (2) the meteorological processes contributing to interstate transport; (3) the chemical transformations which emissions undergo during transport; (4) monitoring results; (5) a qualitative description of the extent and frequency of interstate air pollution problems; and (6) the methods which are available for use in attempting to quantify the contribution that interstate air pollution makes to air and environmental quality problems in states downwind of major source areas.

Pollutants which may undergo long range transport and contribute to regional pollution problems in multi-state areas are ozone, sulfates, and nitrates. Sulfates and nitrates are formed when parent compounds (sulfur dioxide, nitrogen oxide, and others) emitted to the atmosphere undergo complex chemical reactions during transport. Similarly, ozone is a product of sunlight activated chemical reactions between volatile organic compounds (VOC) and nitrogen oxides (NO_x). Management of these reactive byproducts is dependent upon control of the primary or precursor emissions.

Emissions

The precursor emissions for ozone (VOC and NO_X) are introduced into the atmosphere primarily from anthropogenic sources. On a nationwide basis, transportation related sources are responsible for approximately 40% of the manmade VOC emissions, while industrial processors and solvent users are responsible for another 50%. The principal sources of ozone precursors are concentrated in urban and industrialized areas throughout the U.S.

Principal anthropogenic sources of nitrogen oxides are the transportation sector (40%), the utility sector (31%), and the industrial sector (24%). Nitrogen oxide emissions from natural sources may be significant compared with anthropogenic sources. The situation with respect to the release of oxides of nitrogen from managed agricultural soils also needs further clarification.

The sulfur dioxide emissions that are responsible for sulfate formation are in large part released by the combustion of fossil fuels in large industrial facilities. Emissions of sulfur compounds from natural sources may be important globally, but the extent to which they play a part in emissions in the U.S. when viewed regionally is probably minimal.

As was previously mentioned, precursors that form acidic materials are thought to be principally sulfur dioxide and nitrogen oxides.

Meteorological Processes

Diffusion and transport are the two physical processes which principally determine the concentration of pollutants downwind of a source. Diffusion refers to the dilution of a pollutant in an air mass; transport refers to larger scale air motions which can carry the pollutant in a horizontal direction.

Early in our study of air pollution we focused on the fate of pollutants within a few kilometers of a major source. Within this distance, dispersion is extremely important, and is difficult to understand completely. Moreover, it takes only a short time for pollutants to be transported over this distance so that substantial transformation of reactive compounds like SO_2 and VOC does not occur.

A case in point is ozone which historically was thought to originate and remain in the vicinity of the high precursor emission density urban areas. Ozone production generated through secondary reaction processes involving urban emissions is still a dominant factor in accounting for ozone levels in U.S. cities. New evidence has shown that ozone and its precursors are not necessarily confined to an urban complex, but can be transported hundreds of kilometers over several days.

Therefore, it becomes necessary to understand and quantify the contribution of pollutants that have been transported long distances to an urban center so that equitable solutions for meeting the ozone air quality standard can be reached.

We have used satellite photographs and the analysis of meteorological and multi-state air pollution data to understand the long-range transport phenomenon. We have observed periods when pollutants accumulated in hazy air over the midwest and traveled across the eastern United States in a period of days. During these so called "episodes", high ambient concentrations of ozone and sulfates have been observed in multi-state areas indicating that the pollutants were transported with the air mass as it traveled. The study of air pollution episodes and futher analysis has brought us to our current understanding of the processes involved in long-range transport.

The most important mechanism by which pollutants are concentrated in an air mass occurs when a high pressure air mass stagnates over a source of high emissions. Air circulation and recirculation within the high pressure area carries aloft and concentrates pollutants in the air mass. Once the high pressure area begins to move, the polluted air mass typically moves under the influence of an incoming front. Under this type of circumstance, the transport of air masses that contain high pollutant concentrations may occur over long distances.

This is a rather simple description of one mechanism for long-range transport. Long distance movement of air pollutants may be complicated by one or more factors. In actuality, the horizontal distance over which a pollutant is transported is strongly influenced by its overall lifetime or residence time in the atmosphere, the characteristics of the mean wind, regional air movement, topography, and the time of day and height at which the pollutant is emitted into the atmosphere. Residence times for pollutants are governed in part by the extent of wet and dry removal and chemical transformation the pollutant species undergoes in the atmosphere.

In addition, the transport of pollutants such as SO_2, which have appreciable dry deposition rates, is dependent to some degree upon the relative height at which the pollutant is emitted. Pollutant distributions are sensitive to the stability of the atmosphere which governs the extent of vertical mixing.

Of particular importance to horizontal transport is the strength and time of formation of the nocturnal inversion, a stable layer of air formed at the surface due to the differential cooling of the earth's surface relative to the air at night. The depth of the stable layer can vary from approximately 50 to 500 meters depending on meteorological conditions. At the onset of the nocturnal inversion all pollutants present in the well mixed layer from that day's emission are cut off from the surface by this stable layer of air. No major mechanisms for vertical transport through this layer exists; so dry deposition processes virtually stop, leaving the pollutant reservoir aloft free to move long distances with negligible losses other than through transformation. In addition, horizontal mean winds are typically enhanced in layers aloft due to the reduction in frictional drag at the earth's surface as a result of the presence of the stable nocturnal layer. This creates a nocturnal jet, which may be capable of moving a disassociated layer of polluted air several hundred kilometers over night.

Atmospheric Chemical Reactions and Cleansing Mechanisms

The mechanisms for the formation of ozone are extremely complex. To generalize, NO_x reacts with VOC in a polluted atmosphere to form ozone through a cycle of photochemical oxidation processes. Even though many details of this cycle are still not well understood, significant progress has been made so that it is now possible to predict quantitatively for an isolated urban area the relationship between precursor concentrations and ozone production. It is important to recognize that some of these reactions are reversible. Once formed, ozone concentrations can be temporarily reduced by the emission of more NO_x into the air mass. However, the introduction of this NO_x can, at times, cause higher concentrations of ozone over time as the air mass moves further downwind and ages.

Sulfates are formed from the oxidation of SO_2, whereas nitrates result from the oxidation of emitted nitrogen oxides. The chemical pathways by which these two pollutants are formed are also complex and not fully understood. Several alternative chemical pathways are possible for sulfates. Which of these is followed depends upon the temperature, moisture and pollutant content of the air mass into which the precursors are entrained, as well as the intensity of sunlight to which they are exposed. For both sulfates and nitrates, the final reactions are non-reversible. That is, once sulfates or nitrates are formed they remain suspended in air masses until removed by deposition, primarily as dilute sulfuric and nitric acids or their salts.

Much of the uncertainty concerning the atmospheric chemistry pertaining to these substances is related to the rates at which the secondary pollutants are formed. Also to some degree, the full array of chemical precursors require further analysis. In turn, this means that we can not be certain about the precise distance from a source region that is required to complete a chemical reaction of interest. In general, in an aged air mass the final products of these chemical processes are sulfates, nitrates, and ozone, and other oxidants.

MONITORING RESULTS

The monitoring of ozone in major U.S. cities has proceeded for over the past five years with considerable data collected, documenting the nonattainment of the national ambient ozone standard in many urban areas. Much less adequately characterized is the concentration and real extent of ozone in rural and remote areas. Recent information gathered in part from intensive field experiments and regionally oriented monitoring networks, have demonstrated the existence of multi-day episodes of high ozone concentration that occur mainly during the summer and can encompass significant portions of the U.S.

The Sulfur Regional Experiment Program has provided sulfate monitoring over much of eastern North America during much of 1978 and 1979. Annual sulfate concentrations in the midwest and northeast have been found to range between six and twelve micrograms per cubic meter. The region where the concentration profile occurs is the upper Ohio River basin. Summertime concentrations are substantially above the annual values and episodes occur whose 24-hour concentrations can, at times, be in excess of 50 micrograms per cubic meter. During air stagnation episodes, sulfate concentration may be continuous across many state boundaries. These polluted air masses have been traced as they move far over the Atlantic Ocean and they have occassionally been observed to circle back over the continent far from the region of origin.

Monitoring for wet acidic deposition has greatly improved in quantity and quality over the past two years. The quality of the data from the more than a hundred monitoring stations now operating is much superior to that of a few years ago. Data acquired during the last several years indicate that large portions of eastern North America and the West Coast have quite acidic precipitation averaged over an annual cycle. Many individual storm events in the northeast have rainfalls with pHs in values less than 4.0. A recent Electric Power Research Institute report on rainfall in the Adirondack lake region of New York indicates that during a six month period in 1978 in thirty-one events the pH of the precipitation was less than 4.0, and in seventeen events it was greater than 4.0.

Transport Studies

Although we do not fully understand the rate and means by which ozone, sulfates and nitrates are formed, in the case of ozone and sulfates we have strong evidence indicating these pollutants undergo long range interstate transport, even though frequently under different circumstances for the two pollutants. In recent years, a number of studies of long range transport have been carried out which provide information on the nature of interstate transport, but do not provide adequate analysis tools to address the issue. I will relate some of the findings of these investigations without going into the technical detail and without specifying all of the limitations and assumptions associated with them.

In 1975, air pollution officials from 19 states in the northeast met to discuss what might be done to better understand the regional ozone problem. An outcome of this meeting was extensive analyses of meteorological and ozone monitroing data which indicated that very high ozone levels are frequently observed in and downwind of urban areas. Elevated ozone levels were found to occur throughout the region during episodes of air stagnation. A case of medium range analysis of monitoring data and a calculation of trajectories during 1976 episodes in the New York--Philadelphia area suggested that high ozone concentrations were caused by the superposition of urban pollutant plumes upon airmasses transported long distances within the region during the episodes. The conclusions of the study were that during regional episodes one half or more of ozone was advected into the area.

Studies analyzing measured data and air mass trajectories for regional ozone episodes have indicated that pollutants from areas of high emission densities in the Midwest and Gulf Coast may be transported to the northeastern sector of the United States. Studies done in recent years indicate that regional oxidant episodes occur on an average frequency of about twenty times during the six month period from April through September and that an episode is likely to last for an average of five days.

Sulfates are also subject to long-range transport. Data on air movement and measured sulfate air pollution concentrations indicate that elevated sulfate levels in the Northeast and New England have coincided with the arrival of air masses from the midwest. Other studies have shown that the northward movement of sulfates across the upper Ohio River Valley occurs at times during the summer months.

Monitoring data shows that rainfall with an average pH of 4.3 and wet sulfur deposition of about 30 kg/hectare occurs over an area that extends from the Ohio River basin into New York. The western section of this region corresponds with the area of highest SO_2 emission. This and other factors cited suggest a relationship between the long-range transport of sulfates from the midwest and the acidic deposition observed in the northeast. This relationship is a hypothesis which has not been subject to experimental verification to date.

Source-Receptor Relationships

In order to quantify the magnitude of the interstate contribution to a particular area's pollution concentrations or acidic deposition rates much more than this circumstantial evidence is required. Such quantification requires the use of calibrated and verified long-range transport models.

A long-range transport model is a mathematical representation of the physical processes involved in transport, namely:

1) the emissions of primary pollutants;
2) their transport;
3) any chemical transformation they undergo once emitted; and
4) the removal of the directly emitted pollutants and their reaction products from the atmosphere.

Typically, models require detailed information on the magnitude and distribution of emissions, meteorological data, and estimates of chemical rates of transformation and deposition. Once calibrated and verified a model can be a useful tool in evaluating the relationships between the emission source areas which contribute pollution to a defined downwind or receptor area during a particular part of the year. Thus, they are a means by which one can predict the degree to which interstate pollution contributes to pollutant concentrations and deposition rates in a downwind state and the degree to which the emission areas upwind add to the this cumulative impact. There are a number of long-range transport models which are in various stages of development. In interpreting the results from these models it is important to understand their structure.

First, there is no model which can demonstrate the impact of a single source on an area for downwind. Long-range models developed are limited to estimating the impacts of emissions from all sources within an area to other relatively large areas. Second, the physical and chemical processes in the long-range transport are not fully understood, and as in any modeling exercise, simplifying assumptions are used and these will introduce varying levels of error. Uncertainty is further introduced by imperfect data inputs; that is, our information about emissions, meteorology and deposition rates cannot be expected to be absolutely certain. And finally, it is not possible to know for certain whether a model is estimating the correct source-receptor relationships because it would be unreasonable to expect perfect monitoring data on ambient pollutant levels and deposition rates to verify the results of the model. This latter difficulty is similar to that experienced in the Agency's local scale Gaussian plume modeling exercises.

In spite of these uncertainities, regional-scale models have been developed and partially validated which quantify the long-range transport of sulfur dioxide and sulfates. For example, the Advanced Statistical Trajectory Regional Air Pollution (ASTRAP) model has been developed and applied under the DOE/EPA/MAP3S/RAINE program. It has been used to estimate eastern U.S.--Canada sulfur deposition budgets, air quality impacts in the northeastern U.S. from oil-to-coal conversion in utility plants, and optimal sites for additional monitors. The model, at present, underestimates the ambient concentrations of sulfates but apparently closely portrays the pattern of ambient concentrations and sulfate deposition.

Application of regional scale sulfur models has suffered in the past from lack of adequate validation. It has not been known how adequate the current generation of models is to reproduce the large scale pollutant concentration and deposition patterns for North America. Progress in assembling the required monitoring and other data bases has been proceding at a rapid pace. Eight annual concentration models of varying degrees of sophistication are undergoing evaluation against monitoring data sets and intercomparison in the U.S.-Canada MOI Work Group setting.

These tools are useful in giving us a preliminary understanding of the nature and extent of interstate sulfate air pollution and sulfate deposition. It must be emphasized that our ability to perform such analyses should increase significantly over the next few years, leading to an increasing confidence in the results produced.

A model for studying regional oxidant formation and transport is under development under the Agency's Northeast Regional Oxidant Study program. Current schedules anticipate that this model will be ready for validation in calendar year 1984. It will incorporate the principal chemistry features of oxidant formation, and may be an important step towards the development of a scientifically more reliable regional acid deposition model.

This concludes my prepared statement. I would now be happy to respond to your questions.

UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

FOR RELEASE ON DELIVERY
EXPECTED AT
JUNE 30, 1981

STATEMENT OF
DAVID L. JONES, SENIOR GROUP DIRECTOR
COMMUNITY AND ECONOMIC DEVELOPMENT DIVISION

BEFORE THE
SENATE COMMITTEE ON ENVIRONMENT AND
PUBLIC WORKS

ON
THE INTERSTATE TRANSPORT OF

SULFUR DIOXIDE AND TOTAL SUSPENDED
PARTICULATES

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE:

WE ARE HERE TODAY AT YOUR REQUEST TO DISCUSS THE LIMITATIONS OF THE CLEAN AIR ACT IN ADDRESSING THE PROBLEM OF INTERSTATE TRANSPORT OF SULFUR DIOXIDE AND TOTAL SUSPENDED PARTICULATES. THE CLEAN AIR ACT, AS AMENDED IN 1970, RECOGNIZED THAT POLLUTANTS EMITTED IN ONE STATE COULD ADVERSELY AFFECT AIR QUALITY IN ANOTHER STATE. IN ENACTING THE 1977 AMENDMENTS, THE CONGRESS DETERMINED THAT THE 1970 AMENDMENTS HAD NOT PROVIDED ADEQUATE PROTECTION AGAINST THE INTERSTATE TRANSPORT OF POLLUTION. ACCORDINGLY, THE CONGRESS INCREASED THE ENVIRONMENTAL PROTECTION AGENCY'S (EPA'S) AUTHORITY TO DEAL WITH THE PROBLEM. THE AMENDMENTS REVISED SECTION 110(a)(2)(E) OF THE ACT TO REQUIRE THAT EPA APPROVE A STATE IMPLEMENTATION PLAN ONLY IF:

> "* * *IT CONTAINS ADEQUATE PROVISIONS * * * PROHIBITING ANY STATIONARY SOURCE WITHIN THE STATE FROM EMITTING ANY AIR POLLUTANT IN AMOUNTS WHICH WILL (I) PREVENT ATTAINMENT OR MAINTENANCE BY ANY OTHER STATE OF [AN] AMBIENT AIR QUALITY STANDARD, OR (II) INTERFERE WITH MEASURES REQUIRED TO BE INCLUDED IN THE APPLICABLE IMPLEMENTATION PLAN FOR ANY

OTHER STATE* * *TO PREVENT SIGNIFICANT DETERIORATION OF AIR QUALITY OR TO PROTECT VISIBILITY * * *"

MANY STATES STILL BELIEVE, HOWEVER, THAT THEY ARE ADVERSELY AFFECTED BY THE INTERSTATE TRANSPORT OF POLLUTANTS.

FACTORS WHICH HAVE HAMPERED EFFORTS TO IMPLEMENT THE CLEAN AIR ACT PROVISIONS FOR ADDRESSING THE PROBLEM INCLUDE

--EPA'S LIMITED TECHNICAL CAPABILITY TO ACCURATELY IDENTIFY AND ASSESS THE PROBLEM OF INTERSTATE TRANSPORT OF POLLUTANTS, PARTICULARLY IN THE SCIENCE OF AIR QUALITY MODELING;

--THE BROAD LANGUAGE OF THE ACT WHICH MAKES IT DIFFICULT TO DEAL WITH SPECIFIC SITUATIONS, AND

--LACK OF EPA REGULATIONS TO CLARIFY THE LANGUAGE OF THE 1977 AMENDMENTS.

IN SHORT, THE INTERSTATE TRANSPORT OF HARMFUL POLLUTANTS CONTINUES TO BE A MAJOR ENVIRONMENTAL PROBLEM AND IS THE CAUSE OF NUMEROUS DISPUTES BETWEEN STATES, INDUSTRIES, AND EPA AS TO WHAT NEEDS TO BE DONE TO EFFECTIVELY RESOLVE IT.

OUR OBSERVATIONS CONCERNING THE PROBLEM ARE BASED ON DISCUSSIONS WITH EPA PROGRAM MANAGERS AND RESEARCHERS, ENVIRONMENTAL GROUPS, AND STATE OFFICIALS. WE HAVE DISCUSSED OUR VIEWS WITH EPA OFFICIALS AND THEY ARE IN GENERAL AGREEMENT.

AIR QUALITY MODELING PROBLEMS

TO DETERMINE IF A SOURCE OF POLLUTION IS ADVERSELY AFFECTING AIR QUALITY IN ANOTHER STATE, IN VIOLATION OF THE PROHIBITIONS OF THE ACT, EPA USES AIR QUALITY MODELS. MODELING CAPABILITIES ARE LIMITED, HOWEVER, AND PROBLEMS ARE ASSOCIATED WITH THEIR USE.

ONE BASIC PROBLEM IS DECIDING WHICH MODEL TO USE; EPA HAS APPROVED SEVERAL MODELS FOR USE IN DIFFERENT SITUATIONS. FOR EXAMPLE, EPA GUIDELINES RECOMMEND ONE TYPE OF MODEL FOR USE IN

MODELING EMISSIONS FROM A SINGLE SOURCE WHERE THERE ARE NO MAJOR METEOROLOGICAL OR TERRAIN VARIABLES. ANOTHER EPA-APPROVED MODEL IS RECOMMENDED FOR MODELING THE SHORT TERM EFFECTS OF MULTIPLE SOURCES. HOWEVER, EPA APPROVED MODELS MAY NOT BE APPLICABLE FOR EVERY SITUATION.

ANOTHER MODELING WEAKNESS IS THE NEED FOR ASSUMPTIONS WHERE ACTUAL DATA IS NOT AVAILABLE. PROHIBITED INTERSTATE TRANSPORT OF POLLUTANTS IS MOST LIKELY TO OCCUR DURING THE WORST COMBINATION OF METEOROLOGICAL AND OPERATING CONDITIONS. ACTUAL DATA ON THESE CONDITIONS IS OFTEN NOT AVAILABLE AND ASSUMPTIONS ABOUT THEM HAVE TO BE MADE. THE CHOICE OF THESE ASSUMPTIONS CAN LEAD TO CONTROVERSY. FOR EXAMPLE, IN ONE DISPUTE THE AIR QUALITY MODEL USED BY ONE STATE IN ITS PETITION AGAINST ANOTHER STATE, ASSUMED METEOROLOGICAL CONDITIONS THAT WOULD CAUSE EMISSIONS TO DROP TO GROUND LEVEL BEFORE THEY COULD DISPERSE. BASED ON THESE ASSUMPTIONS, THE MODEL PREDICTED A VIOLATION OF AN AMBIENT AIR QUALITY STANDARD. THE ASSUMPTIONS WERE CHALLENGED, HOWEVER, BY THE AFFECTED STATE, WHICH CLAIMED THAT APPLYING SUCH ASSUMPTIONS WAS NOT VALID OR REALISTIC.

PERHAPS THE MOST SERIOUS DEFICIENCY OF MODELS, HOWEVER, IS THEIR LACK OF ACCURACY. AN EPA MODELING EXPERT TOLD US THAT EVEN AT LOCATIONS VERY CLOSE TO THE SOURCE BEING MODELED, ACTUAL CONCENTRATIONS OF A POLLUTANT CAN VARY 50 TO 200 PERCENT FROM THOSE PREDICTED BY AN EPA APPROVED MODEL. MODELS BECOME LESS ACCURATE AS THE DISTANCE BETWEEN THE SOURCE AND THE POINT OF IMPACT INCREASES. MOREOVER, AT GREATER DISTANCES, THE EMISSIONS FROM MANY SOURCES CAN MERGE. MODELING THE IMPACT OF AN INDIVIDUAL SOURCE FROM AMONG THESE MERGED EMISSIONS IS VERY INACCURATE AT LONG RANGE. FOR INSTANCE, EPA APPROVED TOTAL SUSPENDED PARTICULATES (TSP) AND

SULFUR DIOXIDE (SO2) MODELS HAVE A RANGE OF ONLY ABOUT 30 MILES.

IMPROVING A MODEL'S ACCURACY REQUIRES THAT IT BE VALIDATED. VALIDATION INVOLVES GATHERING LARGE VOLUMES OF DATA ON WEATHER CONDITIONS AND ACTUAL POLLUTANT CONCENTRATIONS. THE MODEL'S PREDICTED VALUES ARE THEN COMPARED TO THE ACTUAL CONCENTRATIONS MEASURED, AND THE MODEL IS REFINED. BECAUSE LARGE AMOUNTS OF DATA MUST BE GATHERED, VALIDATION IS VERY EXPENSIVE. VALIDATING MODELS FOR LONGER RANGE IS EVEN MORE EXPENSIVE BECAUSE MORE DATA IS NEEDED.

IN ADDITION TO PROBLEMS OF RANGE AND MULTIPLE SOURCES, UNKNOWNS ABOUT THE CONVERSION OF SULFUR DIOXIDE TO SULFATES MAKE IT DIFFICULT FOR MODELS TO QUANTIFY THE LONG RANGE IMPACTS OF SULFUR DIOXIDE EMISSIONS. AN EPA MODELING EXPERT TOLD US THAT MODELS DEALING WITH CONVERSION NEED MORE REFINEMENT BEFORE THEY CAN BE APPROVED FOR REGULATORY PURPOSES. EPA OFFICIALS STATED THAT THEY KNOW TRANSPORT AND CONVERSION IS OCCURRING, BUT THEY CANNOT QUANTIFY THE IMPACT OF A PARTICULAR SOURCE ON AMBIENT SULFATE LEVELS FAR DOWNWIND.

PROBLEMS APPLYING THE ACT TO SPECIFIC DISPUTES

MOST OF THE CURRENT INTERSTATE DISPUTES INVOLVE COMPLEX ISSUES WHICH THE BROAD LANGUAGE OF THE ACT DOES NOT SPECIFICALLY ADDRESS. IN SOME CASES, RESOLUTION OF THESE DISPUTES MAY FORCE EPA TO MAKE CONTROVERSIAL INTERPRETATIONS OF THE ACT. IN OTHERS, EPA HAS BEEN ABLE TO AVOID SENSITIVE DECISIONS BECAUSE MODELS CANNOT QUANTIFY AN INTERSTATE IMPACT. HOWEVER, THE ISSUES REMAIN AND WILL NEED TO BE DECIDED EVENTUALLY.

FOR INSTANCE, THE ACT PROHIBITS POLLUTION TRANSPORT THAT PREVENTS ATTAINMENT AND MAINTENANCE OF AN AMBIENT AIR QUALITY STANDARD IN ANOTHER STATE. HOWEVER, NEITHER THE ACT NOR EPA REGULATIONS

EXPLAIN WHETHER AN OUT-OF-STATE SOURCE CONTRIBUTING TO AN AIR QUALITY STANDARD VIOLATION IN ANOTHER STATE IS CONSIDERED TO BE A VIOLATION OF THE ACT IF IN-STATE SOURCES ALSO CONTRIBUTE TO THE VIOLATION.

THE ACT ALSO PROHIBITS A SOURCE OF POLLUTION FROM INTERFERING WITH ANOTHER STATE'S PREVENTION OF SIGNIFICANT DETERIORATION (PSD) MEASURES, BUT THE ACT DOES NOT ELABORATE ON THIS PROHIBITION. FOR EXAMPLE, IT DOES NOT SPECIFY THE AMOUNT OF A PSD INCREMENT THAT CAN BE USED UP BY AN OUT-OF-STATE SOURCE.

LACK OF EPA REGULATIONS

EPA HAS ISSUED NO REGULATIONS SPECIFYING HOW STATES ARE TO COMPLY WITH THE ACT'S REQUIREMENTS CONCERNING INTERSTATE TRANSPORT OF POLLUTANTS IN INDIVIDUAL STATE IMPLEMENTATION PLANS REQUIRED UNDER SECTION 110(A)(2)(E) OF THE ACT. OUR REVIEW OF EPA REGIONAL OFFICE AND STATE FILES FOR NINE NORTHEASTERN AND MIDWESTERN STATES DISCLOSED THAT ONLY ONE PLAN CONTAINED PROVISIONS SPECIFICALLY ADDRESSING THE ACTIONS IT PLANNED TO TAKE SO THAT SOURCES IN THAT STATE DID NOT ADVERSELY AFFECT OTHER STATES. EPA OFFICIALS ACKNOWLEDGED THAT THEY DO NOT REQUIRE SUCH PROVISIONS IN STATE PLANS BUT SAID THAT THEY COMPLY WITH THE ACT'S REQUIREMENT BY IGNORING STATE BOUNDARIES WHEN A SOURCE IS MODELED TO DETERMINE IF IT CAUSES A VIOLATION OF AMBIENT STANDARDS. HOWEVER, MANY EXISTING SOURCES HAVE NEVER BEEN MODELED TO ESTABLISH EMISSION LIMITS, AND THE LACK OF REGULATIONS ADDRESSING INTERSTATE TRANSPORT OF POLLUTANTS GIVES THE STATES NO IMPETUS TO IDENTIFY AND CORRECT INSTANCES OF SUCH TRANSPORT.

QUESTIONS REGARDING THE AMOUNT AND CIRCUMSTANCES OF INTERSTATE POLLUTION TRANSPORT THAT VIOLATE THE PROHIBITIONS OF THE ACT REMAIN UNANSWERED AND THEREFORE HAVE HINDERED THE EFFECTIVE

IMPLEMENTATION OF THE ACT. EPA OFFICIALS TOLD US THAT THEY HAVE NOT ISSUED REGULATIONS ANSWERING THESE QUESTIONS BECAUSE THEY INVOLVE COMPLEX ISSUES WHICH ARE DIFFICULT TO ADDRESS AND BECAUSE MODELING LIMITATIONS--TECHNICAL LIMITATIONS; UNCERTAINTY AS TO WHICH MODEL TO USE; AND USE OF QUESTIONABLE ASSUMPTIONS--WOULD HINDER EFFECTIVE IMPLEMENTATION OF THE REGULATIONS. ONE OFFICIAL ALSO TOLD US THAT EPA CANNOT RESOLVE THESE ISSUES ENTIRELY ON ITS OWN AND THAT CONGRESSIONAL ACTION IS NEEDED.

INTERSTATE TRANSPORT REMAINS A MATTER OF CONCERN

DESPITE THE STRONGER PROVISIONS OF THE 1977 AMENDMENTS, SOME STATE AIR POLLUTION CONTROL OFFICIALS BELIEVE A PORTION OF THE AIR POLLUTION IN THEIR STATES RESULTS FROM SULFUR DIOXIDE AND PARTICULATES EMITTED OUTSIDE THEIR BORDERS AND BEYOND THEIR CONTROL. IN SOME CASES THE STATE OFFICIALS ARE CONCERNED ABOUT A MAJOR SOURCE OR SOURCES (PRIMARILY FOSSIL FUEL POWER PLANTS, STEEL MILLS AND PRIMARY METAL-PROCESSING PLANTS) JUST OUTSIDE THEIR BORDERS. IN OTHERS, THEY ARE CONCERNED ABOUT POLLUTION TRANSPORTED LONG DISTANCES. SUCH CONCERN WAS REFLECTED IN A RESOLUTION ADOPTED AT A FEBRUARY 1981 MEETING OF THE NATIONAL GOVERNORS' ASSOCIATION STATING THAT LONG RANGE AIR POLLUTION TRANSPORT CREATES PROBLEMS IN MANY PARTS OF THE COUNTRY.

MANY COMPLAINTS OF INTERSTATE TRANSPORT ARE AIMED AT SOURCES IN THE MIDWEST. SEVERAL MIDWESTERN STATES HAVE HIGHER SULFUR DIOXIDE EMISSION LIMITS THAN OTHER STATES, TO ALLOW SOURCES TO BURN LOCALLY AVAILABLE HIGH SULFUR COAL WITHOUT CONTROLS OR WITH MINIMAL CONTROLS.

THE NORTHEASTERN STATES ARE VERY CONCERNED ABOUT HIGH SULFUR EMISSIONS IN THE MIDWEST (SEE EMISSIONS MAP, ATTACHMENT I). AIR

QUALITY OFFICIALS IN THE NORTHEASTERN STATES BELIEVE THE SULFUR DIOXIDE CONVERTS TO SULFATES (A TYPE OF PARTICULATE MATTER) AS IT TRAVELS, INCREASING THE AMBIENT PARTICULATE LEVELS AND CAUSING ACID RAIN AND SULFATE DEPOSITS IN THEIR STATES.

OFFICIALS IN OTHER STATES, SUCH AS PENNSYLVANIA AND WEST VIRGINIA, ARE CONCERNED ABOUT WHAT THEY PERCEIVE TO BE INEQUITIES IN EMISSION LIMITS AMONG NEIGHBORING STATES. OHIO HAS HIGHER SULFUR DIOXIDE EMISSION LIMITS THAN PENNSYLVANIA AND WEST VIRGINIA. FOR THIS REASON, PENNSYLVANIA AND WEST VIRGINIA ARE UNDER PRESSURE FROM SOURCES IN THEIR STATES TO RELAX EXISTING SULFUR DIOXIDE LIMITS. (SEE COMPARATIVE EMISSION LIMITS IN ATTACHMENT II.) IN 1976 THE GOVERNOR OF WEST VIRGINIA ISSUED AN EXECUTIVE ORDER DIRECTING THAT EXISTING SULFUR DIOXIDE REGULATIONS NOT BE ENFORCED. THIS ACTION WAS TAKEN IN RESPONSE TO PERCEPTIONS, ON THE PART OF WEST VIRGINIA, THAT IT WAS OVERLY BURDENED BY HIGH EMISSION LIMITS ALLOWED BY EPA IN NEIGHBORING STATES.

SINCE THE 1977 AMENDMENTS MADE IT POSSIBLE FOR STATES TO PETITION EPA CONCERNING THE TRANSPORT OF POLLUTANTS FROM OTHER STATES, SIX STATES HAVE FILED A TOTAL OF EIGHT PETITIONS CLAIMING THEY WERE BEING HURT BY INTERSTATE TRANSPORT OF POLLUTANTS. ALL OF THESE CASES INVOLVE THE ALLEGED TRANSPORT OF SULFUR DIOXIDE OR PARTICULATE EMISSIONS. THE DETAILS OF THESE PETITONS ARE PRESENTED IN ATTACHMENT III. IN ADDITION, AT LEAST THREE LAWSUITS HAVE BEEN FILED AGAINST EPA REGARDING INTERSTATE TRANSPORT.

ISSUES FOR CONSIDERATION

SEVERAL FUNDAMENTAL YET COMPLEX TECHNICAL AND POLICY ISSUES ARISE WHEN REVIEWING THE PROBLEM OF HOW TO EFFECTIVELY ADDRESS INTERSTATE TRANSPORT OF POLLUTANTS. WHILE WE OFFER NO SPECIFIC RECOMMENDATIONS AS TO WHICH COURSE OR COURSES OF ACTION MIGHT

RESOLVE THESE ISSUES, WE DO WANT TO MENTION SOME OF THE IDEAS/ APPROACHES PRESENTED BY VARIOUS STATE OFFICIALS AND RESEARCHERS TO US DURING OUR REVIEW.

MAJOR POLICY ISSUES WHICH WE BELIEVE NEED TO BE RESOLVED INCLUDE

--HOW MUCH INTERSTATE TRANSPORT OF A PARTICULAR POLLUTANT CONSTITUTES THE PREVENTION OF ATTAINMENT AND MAINTENANCE OF AN AIR QUALITY STANDARD?

--HOW MUCH INTERSTATE TRANSPORT CONSTITUTES INTERFERENCE WITH A STATE'S PREVENTION OF SIGNIFICANT DETERIORATION MEASURES?

--EMISSION RATES ALLOWED BY THE STATES INVOLVED IN INTERSTATE TRANSPORT DISPUTES CAN BE SIGNIFICANTLY DIFFERENT. SHOULD SUCH DIFFERENCES BE CONSIDERED IN DECIDING WHETHER INTERSTATE TRANSPORT VIOLATES THE ACT?

--SHOULD INTERSTATE TRANSPORT BE ALLOWED TO CONSUME A STATE'S "GROWTH MARGIN" ACHIEVED BY A STATE WHICH HAS HISTORICALLY REQUIRED CONTROLS STRICTER THAN REQUIRED TO ACHIEVE AND MAINTAIN AN AIR QUALITY STANDARD?

HOWEVER, EVEN IF THE ABOVE POLICY ISSUES ARE RESOLVED, THE CURRENT TECHNICAL LIMITATIONS OF MODELING WILL CONTINUE TO HAMPER THE EFFECTIVE USE OF VARIOUS SECTIONS OF THE ACT TO RESOLVE COMPLAINTS ABOUT LONG RANGE SULFUR DIOXIDE TRANSPORT SUCH AS THOSE MADE ABOUT MIDWESTERN SOURCES BY THE NORTHEASTERN STATES. WE WERE TOLD THOUGH, THAT THERE ARE SEVERAL WAYS OF REDUCING TOTAL SULFUR DIOXIDE EMISSIONS WITHOUT RELYING ON MODELING. HOWEVER, SOME OF THE ALTERNATIVE POLICIES DISCUSSED BELOW MAY REQUIRE CHANGES IN THE ACT.

--SHOULD NATIONAL EMISSIONS STANDARDS BE ESTABLISHED? SUCH AN APPROACH WOULD REQUIRE ALL SIMILAR SOURCES TO MEET

SOME MINIMUM SULFUR DIOXIDE EMISSION LIMIT, EVEN IF IT IS MORE STRINGENT THAN NECESSARY TO ATTAIN THE AIR QUALITY STANDARD IN THE IMMEDIATE VICINITY. SOURCES LOCATED IN AREAS WITH SERIOUS AIR QUALITY PROBLEMS WOULD BE REQUIRED TO MEET STRICTER STANDARDS ESTABLISHED BY STATE AGENCIES, IF THEY ARE NEEDED TO MAINTAIN THE STANDARD. IT IS SUGGESTED THAT SUCH AN APPROACH WOULD MINIMIZE THE INEQUITY ALLEGEDLY CAUSED BY VASTLY DIFFERENT EMISSION LIMITS ON TWO SIDES OF STATE BORDERS. A DISADVANTAGE OF SUCH AN APPROACH IS THE FACT THAT SOME ISOLATED SOURCES THAT HAVE NO APPARENT ADVERSE IMPACT, WILL HAVE TO ADD EXPENSIVE CONTROLS WHICH COULD INCREASE THE COST OF THE PRODUCT OR SERVICE PROVIDED BY THESE SOURCES.

--SHOULD REGIONAL EMISSION STANDARDS BE ESTABLISHED? SINCE MOST OF THE SULFUR DIOXIDE SOURCES ALLEGEDLY CAUSING LONG RANGE INTERSTATE IMPACTS ARE LOCATED IN THE MIDWEST, REGIONAL SULFUR DIOXIDE EMISSION STANDARDS MAY BE MORE APPROPRIATE THAN NATIONAL STANDARDS. ESTABLISHING REGIONAL BOUNDARIES, HOWEVER, COULD BE A PROBLEM, AND STATES THAT HAVE TO IMPOSE EMISSION REDUCTIONS ON THEIR SOURCES FOR THE BENEFIT OF DOWNWIND STATES MIGHT FEEL THEY ARE BEING TREATED INEQUITABLY. A VARIATION OF THIS APPROACH WOULD ESTABLISH EMISSION STANDARDS ONLY FOR CATEGORIES OF SOURCES EMITTING THE MOST SULFUR DIOXIDE. FOR EXAMPLE, IT MIGHT BE MORE PRACTICAL TO ESTABLISH STANDARDS ONLY FOR POWERPLANTS AND, POSSIBLY, SMELTERS.

--SHOULD CURRENT AIR QUALITY CONTROL REGIONS (AQCR) BE EXTENDED? ANOTHER ALTERNATIVE IS THE EXPANSION OF AQCR'S WHICH CURRENTLY ARE RELATIVELY SMALL GEOGRAPHICAL AREAS, TO COVER MUCH LARGER AREAS OF THE COUNTRY. FOR EXAMPLE, AN AQCR COULD INCLUDE THE MIDWEST OR THE MIDWEST AND THE NORTHEAST. IF ANY PART OF THE AQCR IS VIOLATING THE SULFUR DIOXIDE NATIONAL AMBIENT AIR QUALITY STANDARD, ALL MAJOR SOURCES COULD BE REQUIRED TO REDUCE THEIR EMISSIONS. HOWEVER, PROBLEMS SIMILAR TO THOSE ASSOCIATED WITH A REGIONAL EMISSION STANDARD MAY BE EXPERIENCED.

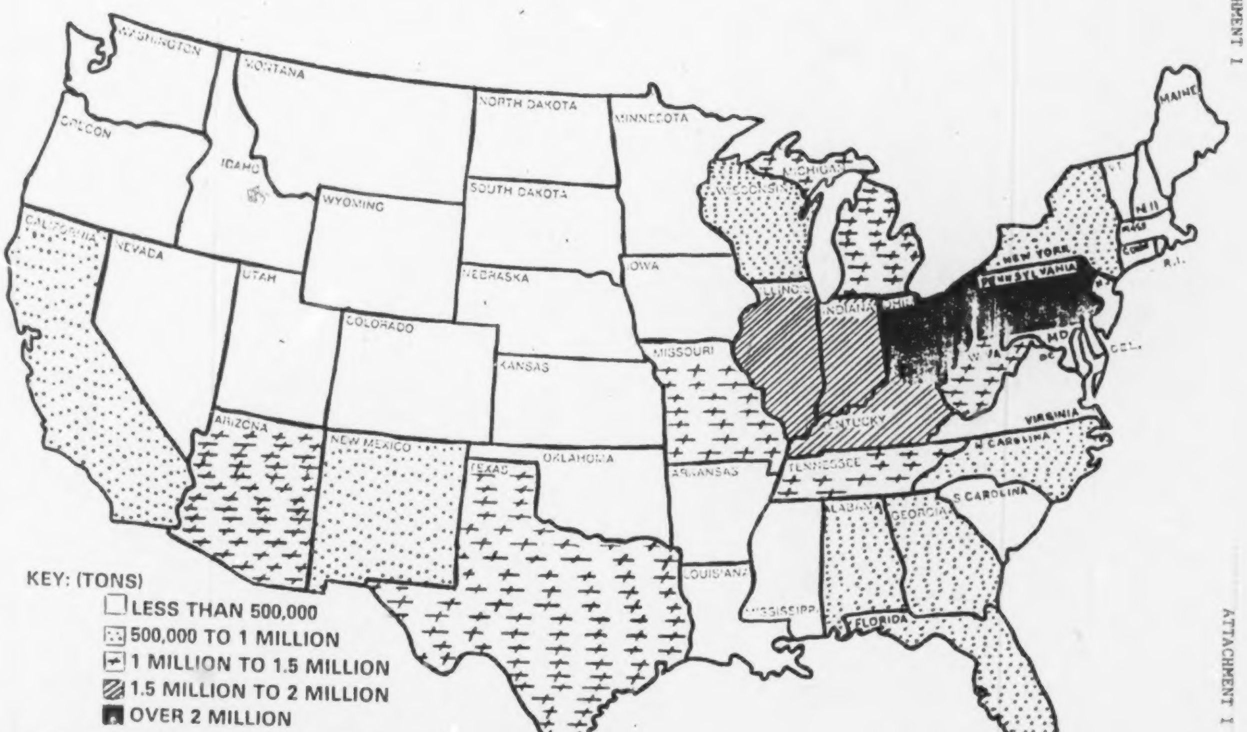
--SHOULD LIMITS BE ESTABLISHED ON STATE SULFUR DIOXIDE EMISSIONS? ANOTHER APPROACH IS TO LIMIT SULFUR DIOXIDE EMISSIONS ALLOWED IN EACH STATE. UNDER THIS APPROACH, THE STATE WOULD DETERMINE WHICH SOURCES TO SUBJECT TO STRICT CONTROLS IN ORDER FOR THE STATE'S TOTAL POLLUTION LOADINGS TO REMAIN BELOW ESTABLISHED LIMITS. THIS WOULD PROVIDE THE STATE FULL AUTHORITY TO APPLY CONTROLS AS IT SEES FIT. HOWEVER, IN ORDER TO ENSURE THAT PUBLIC HEALTH AND WELFARE ARE NOT VIOLATED, NO SOURCE WOULD BE PERMITTED TO EMIT AT LEVELS THAT WOULD VIOLATE THE AIR QUALITY STANDARD. THUS, IT WOULD BE ANOTHER LAYER OF REGULATIONS OVER THOSE NOW IN EXISTENCE. MOREOVER, IF A STATE ALLOWED A SOURCE LOCATED NEAR A STATE BORDER TO EMIT POLLUTANTS AT HIGH LEVELS, INTERSTATE POLLUTION AND, CONSEQUENTLY, INTERSTATE DISPUTES MAY RESULT.

--SHOULD EMISSIONS TAXES BE INSTITUTED? SUCH AN APPROACH WOULD PERMIT A SOURCE TO EMIT POLLUTANTS INTO THE ATMOSPHERE, BUT IT WOULD PAY A TAX TO DO SO. AT SOME POINT, IT WOULD BE MORE ECONOMICAL FOR THE OPERATORS TO INSTALL CONTROL EQUIPMENT. THE ADVANTAGE OF THIS APPROACH WOULD BE THAT THE SOURCE WOULD MAKE THE DECISION BASED ON COST CONSIDERATIONS AND WOULD CHOOSE THE MOST ECONOMICAL

METHOD OF REDUCING ITS TAX. SOME ENVIRONMENTALISTS MAY OBJECT THAT SUCH AN APPROACH WOULD GIVE SOURCES A "LICENSE TO POLLUTE." IF THE TAX IS NOT SET HIGH ENOUGH, THE RESULT COULD BE AN INCREASE IN EMISSIONS AND AMBIENT STANDARDS VIOLATIONS RATHER THAN A DECREASE IN EMISSIONS. ALSO, AS WITH NATIONAL EMISSION STANDARDS, SOURCES IN ISOLATED AREAS THAT WERE PERCEIVED AS HAVING NO EFFECT ON PUBLIC HEALTH AND WELFARE WOULD BE TAXED. SOME MAY BELIEVE THIS TO BE INEQUITABLE.

THIS CONCLUDES MY STATEMENT, MR. CHAIRMAN--WE WOULD BE HAPPY TO ANSWER YOUR QUESTIONS.

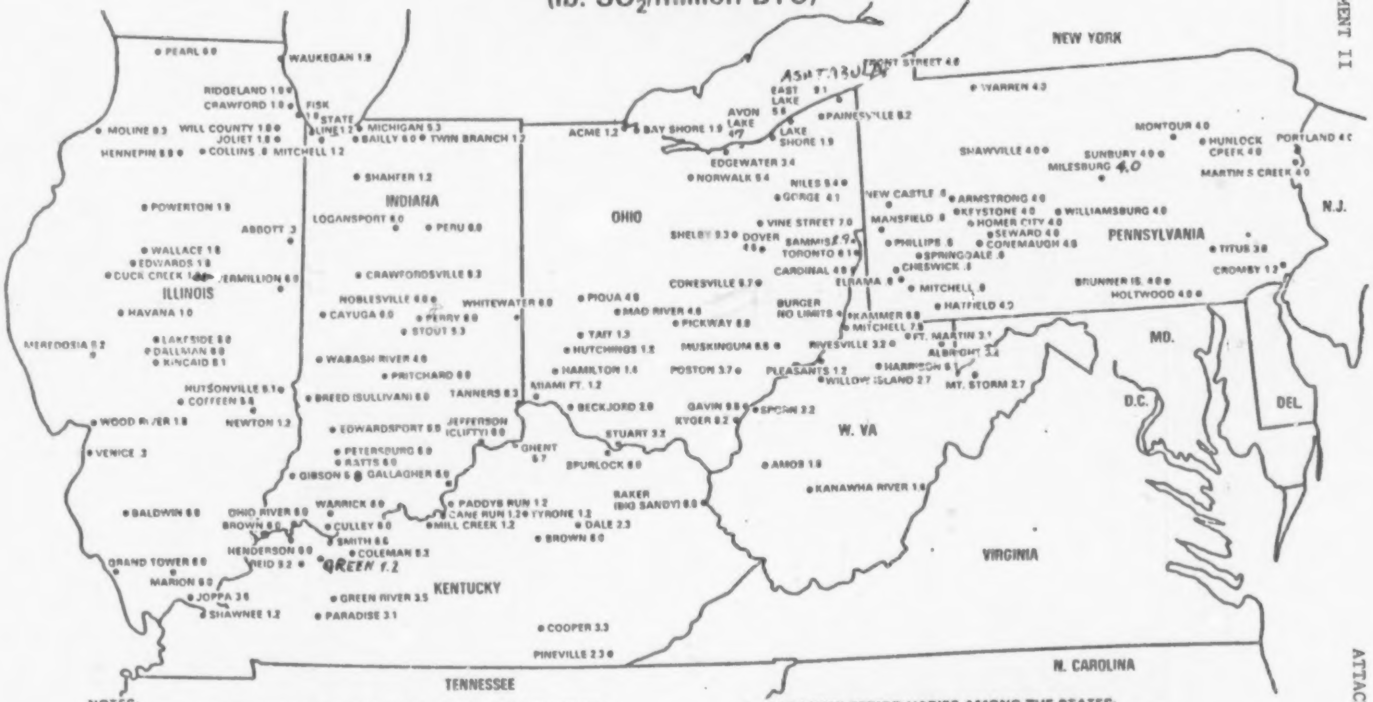
EMISSIONS OF SULFUR OXIDES FROM POINT SOURCES IN CALENDAR YEAR 1977


WASHINGTON
OREGON
CALIFORNIA
NEVADA
IDAHO
MONTANA
WYOMING
UTAH
ARIZONA
COLORADO
NEW MEXICO
NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
KANSAS
OKLAHOMA
TEXAS
MINNESOTA
IOWA
MISSOURI
ARKANSAS
LOUISIANA
WISCONSIN
MICHIGAN
ILLINOIS
INDIANA
OHIO
KENTUCKY
TENNESSEE
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
S CAROLINA
N CAROLINA
VIRGINIA
W VA
PENNSYLVANIA
NEW YORK
MD
DEL.
DC
VT
NH
MAINE
MASS
CONN
R.I.
KEY: (TONS)
☐ LESS THAN 500,000
500,000 TO 1 MILLION
1 MILLION TO 1.5 MILLION
▨ 1.5 MILLION TO 2 MILLION
■ OVER 2 MILLION

SOURCES: "1977 NATIONAL EMISSIONS REPORT"
(EPA-450. .00-005, MAR. 1980)

ATTACHMENT II

SULFUR DIOXIDE EMISSION LIMITS FOR MID-WEST POWER PLANTS
(lb. SO_2/million BTU)


NEW YORK
PEARL 6.0
WAUKEGAN 1.8
RIDGELAND 1.8
CRAWFORD 1.8
FISK 1.8
STATE LINE 1.2
MICHIGAN 5.3
BAILLY 6.0
TWIN BRANCH 1.2
MOLINE 6.3
WILL COUNTY 1.8
JOLIET 1.8
HENNEPIN 6.8
COLLINS .8
MITCHELL 1.2
SHAHFER 1.2
INDIANA
POWERTON 1.8
LOGANSPORT 6.0
PERU 6.0
ABBOTT 3
WALLACE 1.8
EDWARDS 1.8
DUCK CREEK 1.8
VERMILLION 6.0
CRAWFORDSVILLE 5.3
ILLINOIS
NOBLESVILLE 6.0
WHITEWATER 6.0
HAVANA 1.0
CAYUGA 6.0
PERRY 6.0
STOUT 5.3
MEREDOSIA 5.2
LAKESIDE 6.0
DALLMAN 6.0
KINCAID 6.1
WABASH RIVER 4.0
PRITCHARD 6.0
HUTSONVILLE 5.1
COFFEEN 5.5
BREED (SULLIVAN) 6.0
TANNERS 5.3
WOOD RIVER 1.8
NEWTON 1.2
EDWARDSPORT 5.5
JEFFERSON (CLIFTY) 6.0
VENICE .3
PETERSBURG 6.0
RATTS 6.0
GIBSON 6
GALLAGHER 6.0
GHENT 5.7
WARRICK 6.0
PADDYS RUN 1.2
CANE RUN 1.2
TYRONE 1.2
BALDWIN 6.0
OHIO RIVER 6.0
BROWN 6.0
CULLEY 6.0
MILL CREEK 1.2
SMITH 6.6
HENDERSON 6.0
COLEMAN 5.2
GRAND TOWER 6.0
REID 5.2
GREEN 1.2
MARION 6.0
KENTUCKY
JOPPA 3.6
GREEN RIVER 3.5
SHAWNEE 1.2
PARADISE 3.1
TENNESSEE
ACME 1.2
BAY SHORE 1.9
AVON LAKE 4.7
EAST LAKE 5.6
ASHTABULA 9.1
FRONT STREET 4.0
PAINESVILLE 5.2
LAKE SHORE 1.9
EDGEWATER 3.4
NORWALK 5.4
NILES 5.4
GORGE 4.1
OHIO
VINE STREET 7.0
SHELBY 9.3
DOVER 4.6
SAMMIS 2.9
TORONTO 6.1
CARDINAL 4.6
CONESVILLE 5.7
ELRAMA .6
PIQUA 4.6
MAD RIVER 4.6
BURGER NO LIMITS
KAMMER 6.6
PICKWAY 6.0
MITCHELL 7.5
TAIT 1.3
HUTCHINGS 1.2
MUSKINGUM 8.6
RIVESVILLE 3.2
HAMILTON 1.6
POSTON 3.7
PLEASANTS 1.2
WILLOW ISLAND 2.7
MIAMI FT. 1.2
BECKJORD 2.0
GAVIN 9.5
SPORN 2.2
KYGER 8.2
STUART 3.2
W. VA
SPURLOCK 6.0
AMOS 1.6
KANAWHA RIVER 1.6
BAKER (BIG SANDY) 6.0
DALE 2.3
BROWN 6.0
COOPER 3.3
PINEVILLE 2.3
WARREN 4.3
SHAWVILLE 4.0
MONTOUR 4.0
SUNBURY 4.0
MILESBURG 4.0
HUNLOCK CREEK 4.0
PORTLAND 4.0
MARTINS CREEK 4.0
NEW CASTLE .6
ARMSTRONG 4.0
KEYSTONE 4.0
WILLIAMSBURG 4.0
MANSFIELD .6
HOMER CITY 4.0
SEWARD 4.0
PHILLIPS .6
CONEMAUGH 4.0
PENNSYLVANIA
SPRINGDALE .6
CHESWICK .6
TITUS 3.0
MITCHELL .6
CROMBY 1.2
BRUNNER IS. 4.0
HOLTWOOD 4.0
HATFIELD 4.2
FT. MARTIN 3.1
ALBRIGHT 3.4
HARRISON 6.1
MT. STORM 2.7
MD.
N.J.
DEL.
D.C.
VIRGINIA
N. CAROLINA

NOTES:
1. SIP LIMITS ENFORCEABLE OR EXPECTED TO BE ENFORCEABLE IN 1981.
2. PLANT AVERAGES GIVEN WHEN INFORMATION WAS AVAILABLE; OTHERWISE, THE HIGHEST LIMIT ALLOWED FOR A UNIT WAS GIVEN.
3. AVERAGING PERIOD VARIES AMONG THE STATES:

ILLINOIS – 1 HOUR	PENNSYLVANIA – 24 HOURS
INDIANA – 30 DAYS	KENTUCKY – 30 DAYS
OHIO – 30 DAYS	WEST VIRGINIA – 24 HOURS

A LONGER AVERAGING TIME ALLOWS EASIER COMPLIANCE WITH THE LIMIT. HIGHER EMISSION AT ONE TIME ARE MORE EASILY OFFSET BY LOWER EMISSIONS AT A DIFFERENT PERIOD IN THE AVERAGING PERIOD IF THE AVERAGING PERIOD IS LONGER.

SOURCE: "SURVEY OF UTILITY POWERPLANT EMISSIONS AND FUEL DATA" PREPARED FOR EPA DIVISION OF STATIONARY SOURCE ENFORCEMENT BY ICF INCORPORATED, OCT. 1980

ATTACHMENT II

SUMMARY OF SECTION 126 PETITIONS

A. West Virginia Section 126 Petition - Regarding the Sammis Power Plant in Ohio

Source: Sammis Power Plant of Ohio Edison Power Company

Location of Source: Stratton, Ohio (On the Ohio River immediately adjacent to West Virginia)

Pollutants: Total Suspended Particulates
Sulfur Dioxide

Impacted Area: West Virginia counties: Hancock, Brooke, Ohio, and Marshall

Statement of Case: The part of West Virginia allegedly impacted by the Sammis plant was violating the total suspended particulates and sulfur dioxide National Ambient Air Quality Standards (NAAQS). West Virginia alleges that the Sammis plant emits air pollutants which prevent attainment and maintenance of these standards in West Virginia.

Key Dates:

December 1977:	West Virginia filed its Section 126 petition.
August, 1978:	EPA took enforcement action against the operators of the Sammis plant, claiming violations of particulate emission limits.
September, 1978:	West Virginia withdrew the particulate portion of its petition in response to EPA's enforcement action. The sulfur dioxide portion remained outstanding.

Current Status: The sulfur dioxide portion of West Virginia's Section 126 petition is still outstanding. No public hearing has been held. The operators of Sammis have agreed to add particulate control equipment to the plant.

B. Jefferson County, Kentucky, Section 126 Petition - Regarding The Gallagher Station Plant

Source: Public Service of Indiana Gallagher Station Plant

Location: New Albany, Floyd County, Indiana, on the Ohio River, directly across from downtown Louisville, Jefferson County, Kentucky

Impacted Area: Jefferson County, Kentucky

Pollutant: Sulfur Dioxide

Statement of Case: Air quality modeling performed by EPA Region IV indicated that sulfur dioxide emissions from the Gallagher Plant will interfere with the attainment and maintenance of the sulfur dioxide ambient air standard in Jefferson County, Kentucky. Gallagher was allowed to emit 6 pounds of sulfur dioxide per million BTU whereas the sources in Jefferson County could emit only 1.2 pounds. Because the Jefferson County Air Pollution Control District received no assurance from Indiana that it would incorporate remedies in its State plan, Jefferson County filed a Section 126 petition with EPA.

Key Dates:

May, 1973: EPA approved Indiana's sulfur dioxide State plan. The State plan limits Gallagher's sulfur dioxide emissions to 1.2 pounds per million BTU.

August, 1976: EPA approved revised Indiana regulations with no emission limits imposed on Gallagher.

May, 1979: Jefferson County filed its Section 126 petition.

July, 1979: Indiana submitted a revised statewide sulfur dioxide strategy that would allow Gallagher to emit 6 pounds per million BTU. (EPA has not approved this plan.)

April, 1980: EPA held a public hearing on Jefferson County's petition.

September, 1980: End of public comment period on the petition.

Current Status: No decision has been issued by EPA on this petition.

C. Commonwealth of Kentucky
Section 126 Petition - Regarding
The Clifty Creek Power Plant

Source: Clifty Creek Power Plant operated by the Indiana-Kentucky Electric Power Company

Location: On the Ohio River near Madison, Jefferson County, Indiana

Impacted Area: Portions of Indiana and Kentucky surrounding the plant site

Pollutant: Sulfur dioxide

Statement of Case: The plant is burning high sulfur coal and emitting 6.54 pounds of sulfur dioxide per million BTU. Kentucky's modeling of the plant's emissions predicts violations of the secondary sulfur dioxide ambient air standards in Indiana and Kentucky. Kentucky requested that EPA intervene and implement measures to reduce sulfur dioxide emissions because it believes that excessive emissions from the plant limits future industrial growth in that area of Kentucky. Specifically, it is preventing the construction of a new coal-fired power plant in Trimble County, Kentucky.

The Clifty Creek plant was not in compliance with the 1972 federally approved Indiana State plan. Various court decisions from 1975 to 1979 stated that the Indiana State plan was unenforceable due to procedural defects; EPA decided not to enforce the State plan, waiting for a final decision in this case and for Indiana to develop a revised State plan. Thus, the plant continued to emit sulfur dioxide at levels much higher than the 1972 State plan limit of 1.2 pounds per million BTU.

Key Dates:

May, 1978: Kentucky notified Indiana and EPA Region V of its concern about the plant and proposed to file petition.

December, 1978: Kentucky filed its Section 126 petition.

May, 1979: EPA solicited public comments on the petition.

June, 1979: EPA held a public hearing on the petition.

December, 1979: EPA closed public hearing record.

Current Status: EPA is reviewing the material presented. A decision has not been issued on this petition.

D. State of New Jersey Section 126 Petition - Regarding Test Burns by Consolidated Edison

Sources: - Arthur Kill Generating Station
- Ravenswood Generating Station
Operated by the Consolidated Edison Company of New York

Location: Arthur Kill is located on Staten Island, New York. Ravenswood is located in Queens, New York.

Pollutants: Sulfur Dioxide
Total Suspended Particulates

Impacted Area: Parts of New Jersey

Statement of Case: A proposed relaxation (the proposal was later finalized) of New York's State plan would permit the two sources to use fuel oil with a maximum sulfur content of 1.5 percent. This revision will be enforced for one year. New Jersey contends the State plan relaxation violates 110 (a)(2)(E) because it consumes 46 percent of the 24 hour prevention of significant deterioration increment for sulfur dioxide in portions of New Jersey and exacerbates the particulate emissions problem in an area that is nonattainment for the secondary ambient air standards. New Jersey also contends that the relaxation demonstrates EPA's failure to consider a regional approach to air quality programs.

New Jersey has rejected requests by New Jersey utilities to burn higher sulfur oil. They would prefer to see an equitable regional strategy developed before any sulfur-in-fuel changes are approved. New Jersey also believes New York's air quality analysis, that attempted to justify the State plan relaxation, was inadequate. New Jersey and Connecticut also filed a Petition for Review with the U.S. Court of Appeals for the Second Circuit regarding EPA's final rule allowing the test burn by Consolidated Edison.

Key Dates

January, 1980:	EPA issued proposed rule to approve State plan relaxations permitting test burn.
April, 1980:	EPA extended public comment period on proposed rules.
April, 1980:	New Jersey filed Section 126 petition.

August, 1980: EPA issued final rule approving the State plan relaxation and allowing the Consolidated Edison test burn.

September, 1980: New Jersey and Connecticut (see description of the next Section 126 petition) brought suit against EPA in the U.S. Court of Appeals, Second Circuit, for issuing final approval of the State plan relaxation without holding a public hearing on their Section 126 petitions.

December, 1980: EPA held a hearing in response to the Section 126 petitions filed by New Jersey and Connecticut.

Current Status: EPA is preparing its decision on this Section 126 petition. The New Jersey-Connecticut lawsuit against EPA has not been decided by the Second Circuit of the U.S. Court of Appeals.

E Connecticut Section 126 Petition - Regarding Test Burns by Consolidated Edison

(Note: This petition is similar to the New Jersey petition described previously. Like New Jersey, Connecticut complained about the proposed relaxation of New York's State plan to allow test burns at the Arthur Kill and Ravenswood power plants.)

Source: -Arthur Kill Generating Station
-Ravenswood Generating Station
Operated by the Consolidated Edison Company of New York

Location: Arthur Kill is located on Staten Island, New York
Ravenswood is located in Queens, New York

Pollutant: Sulfur Dioxide
Total Suspended Particulates

Impacted Area: Part of Connecticut for sulfur dioxide and all of the State for total suspended particulates.

Statement of Case: A proposed relaxation of the New York SIP would have permitted the two sources to use fuel oil with a 1.5 percent maximum sulfur content for a one year test burn. Connecticut contends that the State plan revision violates 110(a)(2)(E) because it consumes 21 percent of the 24-hour prevention of significant deterioration sulfur dioxide increment in portions of Connecticut. Connecticut also contends that it would exacerbate the State's existing violations of the particulate ambient air standard.

Connecticut was concerned with the aggregate impact of sources, and the impact on Connecticut's secondary 24-hour sulfur dioxide standard. Also, Connecticut was studying the feasibility of coal conversions that would consume a portion of the remaining air quality reserves. Connecticut officials claim these reserves were gained by requiring Connecticut industries and residents to burn 0.5 percent sulfur fuel, and they resent New York utilities using up some of these reserves.

Key Dates

January, 1980:	EPA issued proposed rule to approve State plan relaxation permitting test burn.
April, 1980:	EPA extended public comment period on proposed rule.
May, 1980:	Connecticut filed Section 126 petition.
August, 1980:	EPA issued final rule allowing the Consolidated Edison test burn.
September, 1980:	Connecticut and New Jersey (see description of previous Section 126 petition) brought suit against EPA in the U.S. Court of Appeals, Second Circuit, for issuing final approval of the SIP relaxation without holding a public hearing on their Section 126 petitions.
December, 1980:	EPA held a public hearing on the Section 126 petition filed by New Jersey and Connecticut.

Current Status: EPA is preparing its decision on the Section 126 petition. The Connecticut-New Jersey lawsuit against EPA has not been decided by the Second Circuit of the U.S. Court of Appeals.

F. Connecticut Section 126 Petition - Regarding Test Burns by Long Island Lighting Company

Source: -Northport Generating Facility
-Port Jefferson Generating Facility
Operated by the Long Island Lighting Company (LILCO)

Location: Suffolk County, New York

Pollutants: Total Suspended Particulates
Sulfur Dioxide

Impacted Area: All of the State and especially Greenwich Connecticut for total suspended particulates

Statement of Case: New York was proposing a State plan relaxation to permit LILCO to burn fuel oil with a maximum 2.8 percent sulfur content. Connecticut contends that this will exacerbate existing violations of ambient air standards for particulates and will interfere with attainment and maintenance of Connecticut's secondary 24-hour sulfur dioxide standard. Moreover, Connecticut claims EPA is giving inadequate consideration to the aggregate impact of sources. Increased emissions from LILCO make it more difficult for Connecticut to attain and maintain ambient air quality standards.

EPA reviewed the technical material submitted by New York State and concurred with the State's determination that no ambient air standard violations would occur; Connecticut, in turn, questioned the competency of the air quality data and modeling.

Key Dates:

July, 1976: EPA approved a special limitation to New York's State plan allowing the use of high sulfur content fuel oil at the LILCO plants.

August, 1977: EPA renewed the special limitation until May 1980.

May, 1980: The special limitation expired.

July, 1980: EPA proposed rule to approve New York's State plan relaxation to permit the burning of 2.8 percent sulfur fuel oil.

August, 1980: Connecticut fileD Section 126 petition.

December, 1980: EPA held a public hearing in response to this and other Section 126 petitions.

Current Status: EPA is preparing a report and decision on the petition.

G. Pennsylvania Section 126 Petition Regarding Various Sources in Ohio and West Virginia

SOURCES:

Ohio		Affecting Ambient Sulfur Dioxide	Affecting Ambient Particulate Matter
Federal Paperboard		x	x
Ohio Power Company	-Cardinal Plant	x	x
	-Gavin Plant		x
	-Muskingum River Plant		x
Ohio Edison Co.	-Sammis Plant	x	x
	-Burger Plant	x	x
	-Niles Plant		x
	-Toronto Plant	x	x
Ohio Valley Electric Coop.	-Kyger Creek Plant		x
Columbus & Southern Ohio Edison Co.	-Conesville Plant		x
Toronto Paperboard		x	x
National Steel Corp., Weirton Division		x	x
Wheeling-Pittsburgh Steel Corp.	-North Plant	x	x
	-South Plant	x	x
	-Yorkville Plant	x	x
	-Martins Ferry	x	x

West Virginia		Affecting Ambient Sulfur Dioxide	Affecting Ambient Particulate Matter
Allied Chemical Corp.	-Coal Fired boilers #1-4	x	x
	-North Plant	x	x
Banner Fiberboard		x	x
City Service Co.	-Reactors #1-4	x	x
Dieckmann and Sons	-boilers	x	x
Globe Refractory	-kilns	x	x
Koppers Company	-boilers	x	x
Mobay Chemicals	-boilers	x	x
Ohio Valley Medical Center	-boilers	x	x
Taylor Smith & Taylor	-boilers	x	x
Triangle Conduit	-boilers	x	x
U.S. Stamping	-boilers	x	x
Valley Camp Coal	-coal dryers	x	x
National Steel Corp.	-Brown Island coal battery	x	x
Mainland Coke	-coke batteries	x	x
National Steel Corp.	-wind box	x	x
Wheeling-Pittsburgh Steel	-Benwood Plant	x	x
	-Fallensbee Plant	x	x
National Steel Corp.	-Weirton Division	x	x
Ohio Power Co.	-Mitchell Plant	x	x
	-Kammer Plant	x	x
Monongahela Power Co.	-Harrison Plant		x

Location of Sources: Various locations in Ohio and West Virginia

Pollutants: Total Suspended Particulates
Sulfur Dioxide

Impacted Area: State of Pennsylvania

Statement of Case: Pennsylvania claims that major sources in upwind states emit sulfur dioxide and particulate matter that exacerbates Pennsylvania's air pollution problem and causes an adverse economic impact by requiring Pennsylvania to adopt stricter emission limitations for its industries.

Pennsylvania also claims that EPA has permitted major sources to avoid emission controls by the use of taller stacks and ambient modeling which does not consider long distance transport and the impact on downwind states.

Key Dates:

December, 1980: Pennsylvania filed its Section 126 petition.
June 18-19, 1981: EPA held a public hearing in response to this petition.

Current Status: No action taken on the petition.

H. New York Section 126 Petition-Regarding Four Ohio Power Plants

Sources:
- Beckjord Plant owned by Cincinnati Gas and Electric
- Muskingum Plant owned by the Ohio Power Company
- Poston Plant owned by Columbus and Southern Ohio
- Cardinal Plant, owned by the American Electric Power Company

Impacted Area: State of New York

Pollutant: Sulfur dioxide

Statement of Case: Ohio has proposed to revise its State Implementation Plan to relax the sulfur dioxide emission limits for four coal-burning power plants. New York contends that derivatives of sulfur dioxide emitted in the midwest already pollute New York air and contribute to acid rain, and that Ohio's SIP relaxation would aggrevate these problems. New York further states that Ohio's proposal, or if EPA considers the proposal, it must evaluate the proposal along with all pending mid-western sulfur sioxide emission limit relaxations to analyze potential cumulative impacts on New York.

Key Dates:

February 25, 1980:	EPA proposed to approve higher emission limits for Cardinal and Poston, and to disapprove higher limits for Muskingum and Beckjord. (EPA later advised New York it intended to propose approval for higher limits at Beckjord.) NOTE: This information is contained in the petition document, but was not verified by GAO.
January 16, 1981:	New York filed its Section 126 petition.
June 18-19, 1981:	EPA held a public hearing on New York's Section 126 petitions.

TESTIMONY OF ROBERT M. FRIEDMAN

OFFICE OF TECHNOLOGY ASSESSMENT

My name is Dr. Robert Friedman. I am an ecologist on the staff of the Congressional Office of Technology Assessment, and currently direct the OTA study on the Impacts of Atmospheric Alterations, a study that was requested by this Committee. This assessment is at the midway point; thus, our analysis is not yet complete. We appreciate, however, this opportunity to discuss our understanding of long-range transport air pollution, based upon our work to date.

Some air pollutants travel long distances, crossing state and national boundaries. Of greatest concern are acid rain and ozone, which result from the chemical transformation of three primary pollutants: sulfur dioxide, nitrogen oxides, and hydrocarbons. These transported pollutants have been associated with, and in some cases have been identified as a cause of, damage to lakes and streams, forests and soils, agricultural crops, man-made materials and human health.

As preliminary, although tentative, evidence has accumulated which suggests that the impacts of long-range transport pollutants may be extensive, some individuals and groups have called upon the Federal Government to control pollutant emissions more stringently than existing laws call for. Others, pointing to the uncertainties in our knowledge about long-range transport, are concerned that we may act too quickly. They argue that, if we try to control emissions without fully understanding the impacts and processes involved, we may waste money and resources and impose unreasonable costs on industry and the public.

In addition to concerns about resource damage and costs of control, transported pollutants may impose significant inequities, as the impacts might be experienced by different groups, regions, and even nations than those that receive the benefits of the activities that generate acid rain and ozone. Moreover, different groups and regions may bear an unequal share of the costs of transported pollutant control.

Long-range transport pollutants have become an issue for potential Federal action for two reasons. First, these pollutants do not respect political boundaries; they are transported across both state and national borders. Second, Congress is presently considering the reauthorization of the Clean Air Act -- legislation which in its present form does not directly address long-range transport pollution.

In my testimony today, I would like to share with you some of our preliminary thinking about these issues, focusing on what we know and do not know about the long-range transport of air pollutants. Often it is this scientific uncertainty around which the policy debate concentrates. In particular, I shall speak about our current knowledge of the relationship between the emission and deposition of these air pollutants, the current and potential resource effects attributed to them, and the advantages and disadvantages of waiting for more information versus taking action in the face of uncertainty.

Given the scope and complexity of the question, I will divide it into several parts. First I will examine the question of what we know about transported pollutants from the time they are emitted to the time they are deposited. At the very least, we know that pollutants are emitted, that they are transported by prevailing winds, and, in the process, they are transformed into acid rain and ozone. We have good information about the sources and amounts of the primary pollutants, sulfur oxides and nitrogen oxides. EPA researchers have estimated that since the 1950's, man-made emissions of sulfur and nitrogen oxides in the eastern U.S. have more than doubled. We know, moreover, that these pollutants are often emitted from tall stacks high into the atmosphere where they may be transported long distances and transformed into secondary chemical pollutants. We also know that these pollutants emitted into the atmosphere must eventually be deposited somewhere. We can relate large source regions (e.g., the Ohio River Basin) to large receptor regions (e.g., the Adirondacks). However, given our current state of knowledge, we cannot, for example, follow the pollutants emitted from a single power plant to where these pollutants are deposited in a particular lake a thousand miles downwind.

We know much less about the sequence of events after primary pollutants are emitted. We have good data about the meteorology -- the general path the pollutants follow--but a poor understanding of the intricacies of the chemical transformations that occur. We know ozone is a secondary pollutant formed by reaction of nitrogen oxides and hydrocarbons. We know that sulfur oxides and nitrogen oxides are transformed into secondary pollutants -- sulfates, and nitrates. We know there is a substantial correspondance between the concentrations of sulfates and nitrates in rainfall and the acidity of rainfall.

We can measure the acidity and the amount of acid-producing substances in rainfall fairly well, but we cannot accurately measure 'dry-fall' -- acid-producing substances that are deposited when it is not raining. We have difficulty determining historical trends in rainfall acidity because of the uneven quality of historical data. Our techniques to monitor ozone are more advanced, but as with measuring acid rain, our data are not as complete as we would like either in spatial coverage or years of data.

Up to this point, I have described our general understanding of the emission and transport of pollution. Even though we do not know all the scientific details, we do know that some regions emit more pollutants than others and that some regions (not necessarily the same) receive more pollutants than others. These regional differences give rise to a variety of policy issues.

To illustrate the regional variations in emissions and deposition, I will use the sulfur component of acid deposition as an example. I have chosen sulfur products as my example because sulfate is often used to relate acid deposition to effects on lakes and streams. Nitrates, the other major acid producing component in acid rain, are thought to be easily removed by plants in watersheds. However, nitrates may be important in their effect on other resources, and nitrogen oxides, as mentioned earlier, are key components in the production of ozone.

The major sources of man-made sulfur emissions in the United States are fossil-fired utilities, accounting for almost two-thirds of the total 30 million tons of sulfur dioxide emitted annually. Three states -- Ohio, Pennsylvania, and Indiana -- contribute almost 25% of the total; nine states contribute over half of the total U.S. sulfur dioxide emissions. As one can see from this map of emission density (Figure 1), the distribution is not uniform across the easten U.S.

Now that we have seen where the sulfur "goes up", let me show where it probably "comes down". This next map (Figure 2), shows the sulfate deposited in rainfall during the spring and summer of 1979. These data show only part of the sulfur deposited throughout the year -- another 50% is contributed in rainfall in the fall and winter. To this total we must add the contribution from dry fall, which, when averaged over a year, is probably about the same as from rainfall.

As one can see, sulfate "loadings" -- the amount deposited -- is greatest in the northeastern U.S. and southeastern Canada. To put these numbers into perspective, some scientists feel that serious acidification occurs when sulfate deposition exceeds 3000 milligrams per square meter per year ($mg/m^2/yr$) in the most sensitive areas. A large portion of the northeast exceeds this value; deposition in parts of New Hampshire and the Adirondacks is as high as 5000 $mg/m^2/yr$. These same scientists estimate that if sulfate deposition is below 900 to 1200 $mg/m^2/yr$, most lakes and streams are not likely to be acidified.

Let us now look at how the patterns of acidity relate to the distribution of sulfate. As this next map (Figure 3) indicates, the areas of greatest acidity (lowest pH) coincide with areas of high sulfate deposition. The greatest deposition of both acidity and sulfate follows a corridor through the northeastern U.S. and southeastern Canada.

To this point, the information I have presented is incomplete for determining areas that might be affected by acid deposition. In addition, we need to know how sensitive the resources are to acid deposition. For lakes and streams, this means examining the characteristics of soils in the surrounding watershed.

By analyzing the soils, we can determine which areas have the ability to neutralize acidity even though they may receive a large amount of atmospheric loadings. This map (Figure 4), prepared by researchers at Oak Ridge National Laboratory, indicates areas where lakes and streams may be adversely affected by acid deposition. Within these marked areas, there are approximately 100,000 miles of streams and 20,000 lakes. OTA is in the process of estimating what percentage of these lakes and streams are sensitive to current levels of acid deposition.

At this point, we are still left with the question of how much of the sulfur deposited in a state originates from outside the state's boundaries. My next map (Figure 5) presents the percentage of sulfur deposited within regions of the U.S. and Canada that originated outside these regions.

If I may, Mr. Chairman, I would like to qualify these preliminary results. This map is based on very recent modeling results, rather than monitoring data. Furthermore, many people feel that the use of long-range transport pollution models are premature for regulatory or policy purposes, and are still too crude to determine the effects of changes in emissions. On the other hand, models are the only practical method for estimating the current transport of pollutants from one region to another. There is no question that these estimates will be slightly modified over the next few months and years. These models are currently being evaluated and compared to monitoring data by both U.S. and Canadian scientists. Prelimary results should be available in July.

As you can see on this map, all regions in the eastern U.S. and Canada receive some sulfur deposition from outside the region. However, some regions receive a much higher share: New York, for example, appears to receive up to 70% of its total sulfur deposition from outside the state.

We are concerned about transported air pollutants because they have been associated with, or identified as being a cause of, damage to natural resources, man-made materials and human health. What do we know about the effects of acid rain and ozone? Let us turn to this question next.

Certain types of resource systems are not able to neutralize or buffer sustained acid inputs over and above natural production. The great burden of evidence points to adverse effects from acid deposition on lakes and streams, and suggests that altered water chemistry will be the first response in sensitive aquatic systems. Time-trend data show this alteration is now occurring in sensitive areas in New York, New Hampshire, New Jersey, West Virginia, and North Carolina.

For agriculture, we know that ozone may account for up to 75% of air-pollution-related damage to crops. As mentioned, ozone is formed from nitrogen oxides and hydrocarbons and can travel long distances. How much crop damage is due to transported, rather than locally produced, ozone is uncertain. Damage to crops from acid rain under natural conditions has not yet been observed, although experiments using simulated acid rain have resulted in quantifiable alterations of crop quality and in yield reductions.

For forests, we must consider not only direct damage to trees, but also the effects on the soil in which trees grow. Ozone damage to some tree species has been observed, but our knowledge of the concentrations of ozone necessary before damage occurs, and which tree species are most sensitive, is not very good.

Acid deposition may have both positive and negative effects for forests. In some areas, where nitrogen and sulfur in the soil are in short supply, the nitrates and sulfates in acid rain may actually improve forest productivity. On the other hand, there is some evidence which, although not conclusive, suggests that on some sensitive soils acid deposition may remove other essential nutrients, or release metals that are toxic to plants.

We know that air pollution can damage a broad range of materials -- building stone, steel and paint to name a few. But, we have much to learn about which pollutants, or mixes of pollutants are responsible.

Health effects from transported pollutants is a topic of great controversy. Airborne sulfate concentrations correlate with mortality, but whether as a causative agent, or as an indication of other factors not considered, is uncertain. Toxic metals have been found in drinking water -- possibly as a result of acid deposition which can leach metals from soils and plumbing -- but no clear evidence of adverse health effects exists.

Up to this point, I have not discussed the monetary values of these potential effects because the estimation of cost and benefits associated with long-range transport air pollution is not straightforward. In deriving economic estimates of potential resource damage, one of the complications is the problem I have just discussed: the scientific knowledge of both positive and negative impacts upon sensitive resources is incomplete. Furthermore, the economic methods available to assess potential costs of these impacts have significant shortcomings, especially in estimating the value of health, visibility, and historical buildings and monuments.

Though the estimates are preliminary, I would like to review the best available range of estimates of the costs of transported pollutants. High and low estimates compiled, respectively, by USDA and the National Commission on Air Quality, indicate a range of current ozone damage to crops of between $1.8 and $3 billion. An EPA contractor reported that materials damage from acid deposition may total in the billions of dollars as well. Although the amount of materials damage which can be attributed specifically to long-range transport air pollutants is difficult to determine, many scientists believe that materials may constitute the largest single category of economic damage. Economic impacts to lakes and streams and recreational opportunities may be significant but localized. The National Research Council estimates that in the eastern U.S., current losses to sport-fishing from acid deposition to be about $125 million. An EPA contractor estimated total current losses of $250 million from lakes and streams east of the Mississippi.

Estimates of the economic impacts from transported pollutant damage to forests, visibility, and health are only speculative, in part because of gaps in scientific understanding about the extent of resource impacts. However, some scientists believe that the economic significance of potential long-term adverse effects to forests from acid deposition and ozone, in particular, may be great.

At OTA, we are compiling maps of sensitive areas and combining them with current levels of acid rain and ozone to try to estimate the magnitude of potential damage. In a few months, we hope to provide estimates of aquatic ecosystem damage from acid deposition, potential effects to forest productivity from acid deposition and ozone, crop damage from ozone, potential effects on human health, and estimates of materials damage. In addition, we are examining the costs of mitigating resource damage, for example, liming lakes.

Estimating the costs of reducing pollution also presents difficulties. We can, with some accuracy, estimate the direct costs of installing pollution control equipment. We are less successful at estimating a host of indirect costs, such as compliance costs and productivity effects, which might accompany pollution control strategies. These direct and indirect costs could combine to impose unequal, although not easily measured, costs on individual firms, industries, markets, and regions.

Preliminary estimates of control costs are only now being completed by various agencies, including OTA. Many of the control strategies under study focus on older coal-fired plants. The greatest reductions in total nationwide sulfur dioxide emissions could be achieved by controlling these older, less tightly controlled coal-fired utilities. Older plants emit up to eight times as much sulfur dioxide as newer, tightly controlled facilities, and will continue to produce the majority of sulfur dioxide emissions in the country through the end of the century.

To indicate the range of control costs which might be incurred (if further controls are deemed necessary), several contractor studies commissioned by EPA and DOE estimate that by 1990, Eastern utilities could reduce sulfur dioxide emissions by about 30% at costs ranging from slightly less than $1 billion to slightly more than $2.5 billion. These costs would translate into increases in electricity rates of approximately 1 to 2%. However, these estimates do not include indirect costs.

As for estimates underway, DOE, EPA, and the US/Canadian Transboundary Treaty Workgroups are now developing estimates of the costs of controlling man-made sources of acid deposition (such as sulfur and nitrogen oxides). At OTA, we are generating state-by-state utility emission cost curves and evaluating the cost-effectiveness of various strategies for controlling utility and industrial sources.

Given the uncertainties in scientific understanding, and the gaps in our knowledge about costs and benefits, many have questioned whether this is the appropriate time to consider changes to the Clean Air Act that are responsive to transported air pollutants. What are the risks associated with Congressional action or inaction -- the trade-offs between Congressional action during the upcoming reauthorization of the Clean Air Act, or waiting until a better scientific consensus is reached about the extent and implications of transported pollutants?

To put the question in perspective, this Committee may wish to consider how long it might take to counteract the effects of a decision they later felt was wrong.

Let me illustrate with another diagram (Figure 6). This diagram shows for each particular resource at risk, the length of time we think it takes for damage to occur, versus the amount of time we think it would take for recovery once pollutant loadings are reduced. Although highly speculative, this diagram illustrates some important considerations. These include whether the effects are reversible or irreversible, and whether the effects accumulate through time.

For example, crop damage from ozone occurs during a particular growing season. If we are able to eliminate the ozone next year, next year's crops would be normal: the damage is not cumulative from one year to another.

In contrast, lakes and streams may take a long time to acidify — on the order of decades. Each year's deposition may further remove the natural capacity of the watershed to neutralize acid. The effects are cumulative, based on how much acid deposition the watershed received in the past. Many scientists feel that the longer we wait to reduce acid loadings, the more lakes will have become sensitive to acid deposition, even if acid loadings are reduced in the future. The recovery of the lakes and streams will depend largely on the recovery of the soils in the watershed -- and this might take decades.

What other effects might take a long time to recover? Because trees are long-lived, possible forest damage might also take many decades to counteract. Some materials, such as artwork or historical buildings, are irreplaceable.

And last, but by no means least, if we adopt increased pollution controls, the costs will be borne by society for many years. Actions that we take today that we later find to be incorrect or ineffective, will waste money and resources and impose unnecessary costs on industry and the public.

Mr. Chairman, I would now like to summarize the main points in my testimony:

- Transported pollutants have become a political issue for several fundamental reasons: 1) Public concern has increased about the potential resource damage that may be caused by acid deposition and ozone. 2) Similarly, concerns have also grown about inequities which might result from unequal distribution of damages among different groups and regions. 3) The direct and indirect costs of controlling transported pollutants are potentially substantial. 4) Different groups and regions may bear an unequal share of the costs of pollution control.

- Transported pollutants have become an issue for potential federal action for two reasons: 1) These pollutants do not respect political boundaries; they are transported across both state and national boundaries. 2) The existing mechanisms for air pollution control are governed by the Clean Air Act, which may not be adequate to address the problems posed by transported air pollutants.

- Although there is uncertainty about the scientific details, we know that certain air pollutants (sulfur dioxide, nitrogen oxides and hydrocarbons) can be transformed into other pollutants -- including acid rain and ozone -- and transported long distances.

- There are large regional differences in both pollution emissions and pollutant loadings. A large portion of the acid deposition and ozone within a region originates from outside the region, with some regions receiving more than others.

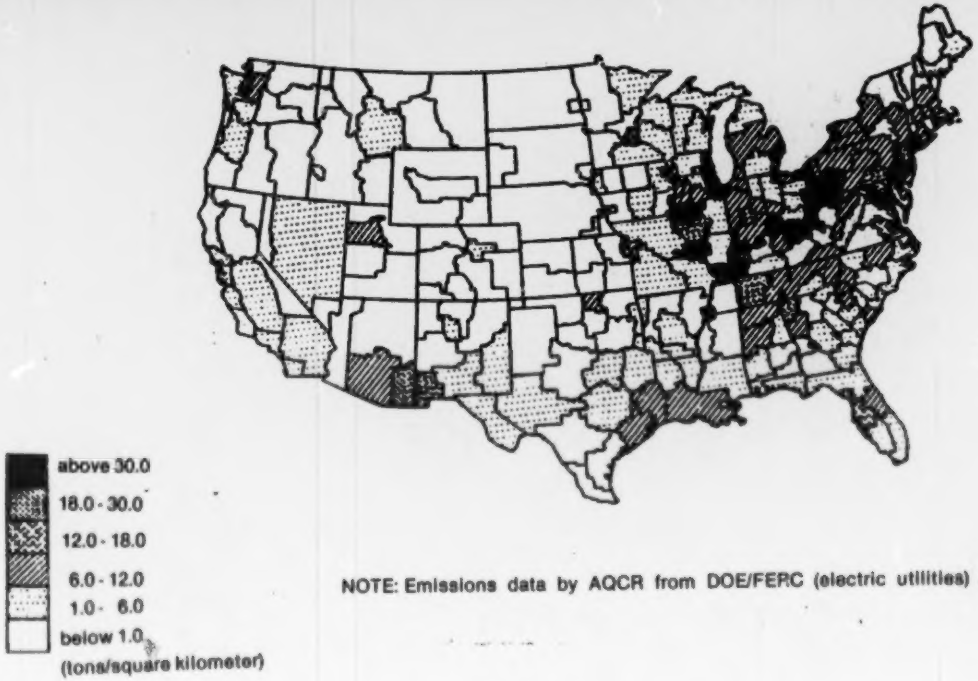
- There is compelling evidence that lakes and streams have acidified over the last few decades, and acid deposition is strongly implicated. Potential effects of acid deposition to forests, agriculture, materials, and human health are of concern from limited experimental evidence, as well as theoretical considerations.

- Agricultural damage from ozone is well established. The extent of ozone damage to forests is less well understood.

- Both the costs of these potential damages and the costs of controls have been estimated to be billions of dollars annually.

- Waiting to control transported pollutants until our understanding improves may result in additional damages that may take decades to recover. Acting too soon to control these pollutants may result in large sums of money ineffectively spent.

Thank you, Mr. Chairman, for this opportunity to testify on our current study. In the next few months, we hope to have additional information and further analyses for this Committee and the rest of the Congress.


above 30.0
18.0 - 30.0
12.0 - 18.0
6.0 - 12.0
1.0 - 6.0
below 1.0
(tons/square kilometer)

NOTE: Emissions data by AQCR from DOE/FERC (electric utilities) and EPA/NEDS

Figure 1.—Emission Densities

SOURCE: DOE, 1981.

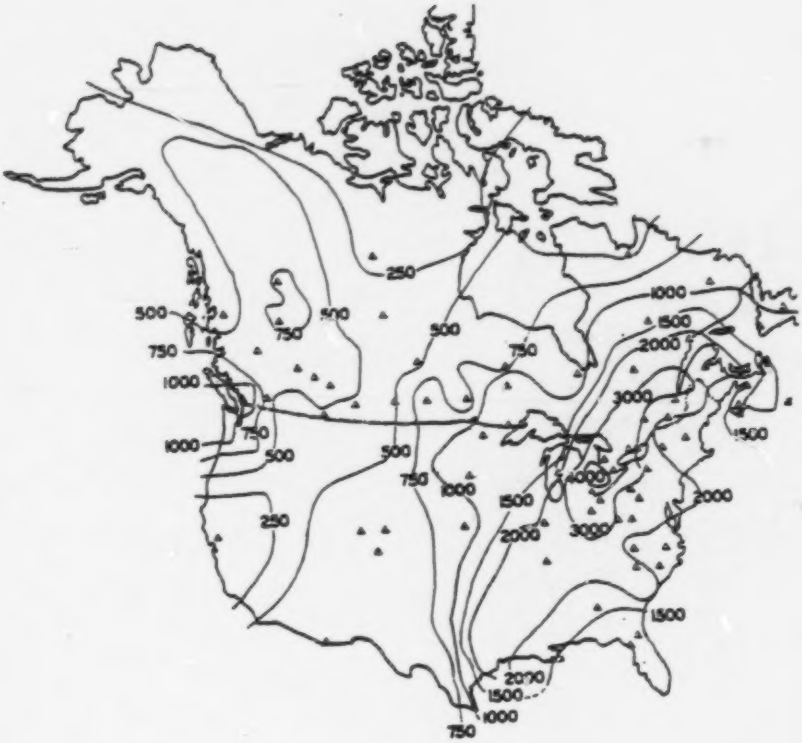

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Figure 2.—Sulfate Wet Deposition (milligrams/meter²)
(April-October 1979)

SOURCE: U.S. EPA from NADP/CANSAP, 1981.

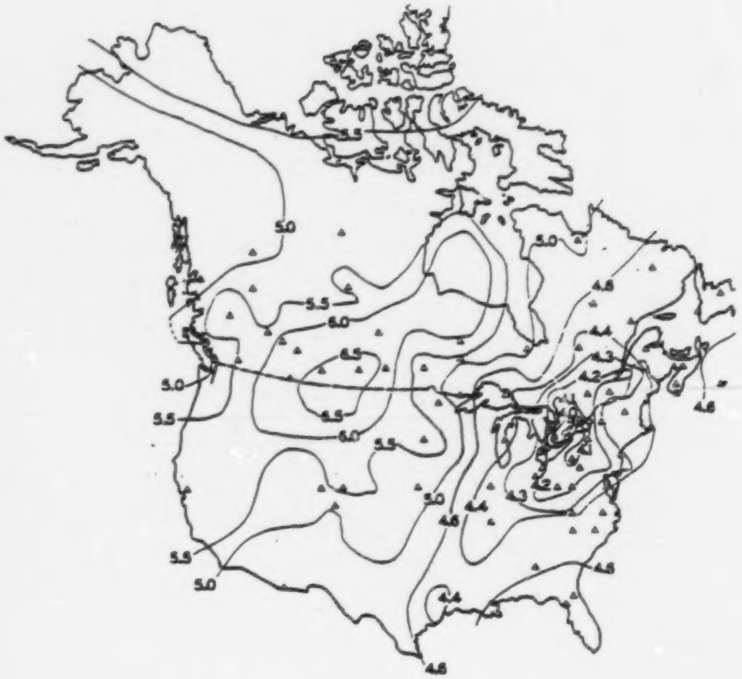
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Figure 3.—Acidity of Rainfall (pH Precipitation Weighted Averages) (April-October 1979)

SOURCE: U.S. EPA from NADP/CANSAP, 1981.

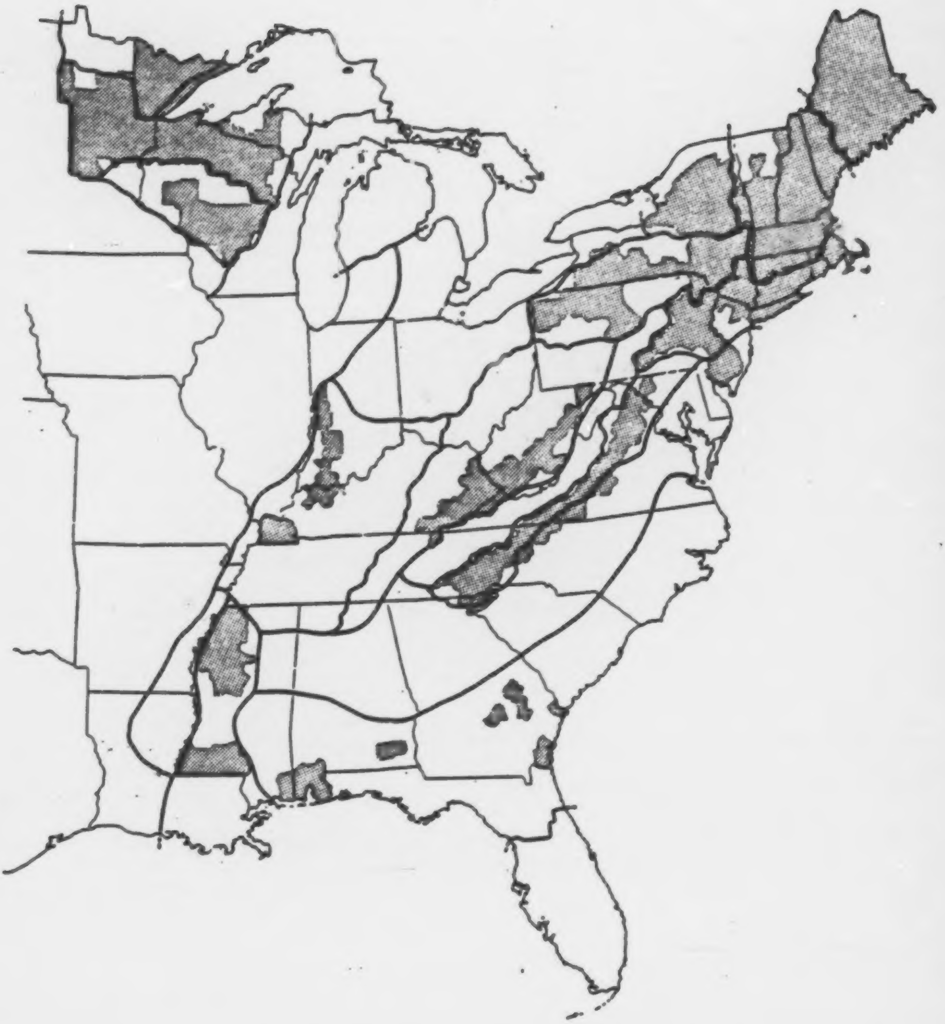


Figure 4.—Areas Identified as Sensitive to Acid Rain (Hatching)

SOURCE: Modified from Olson et. al., 1981.

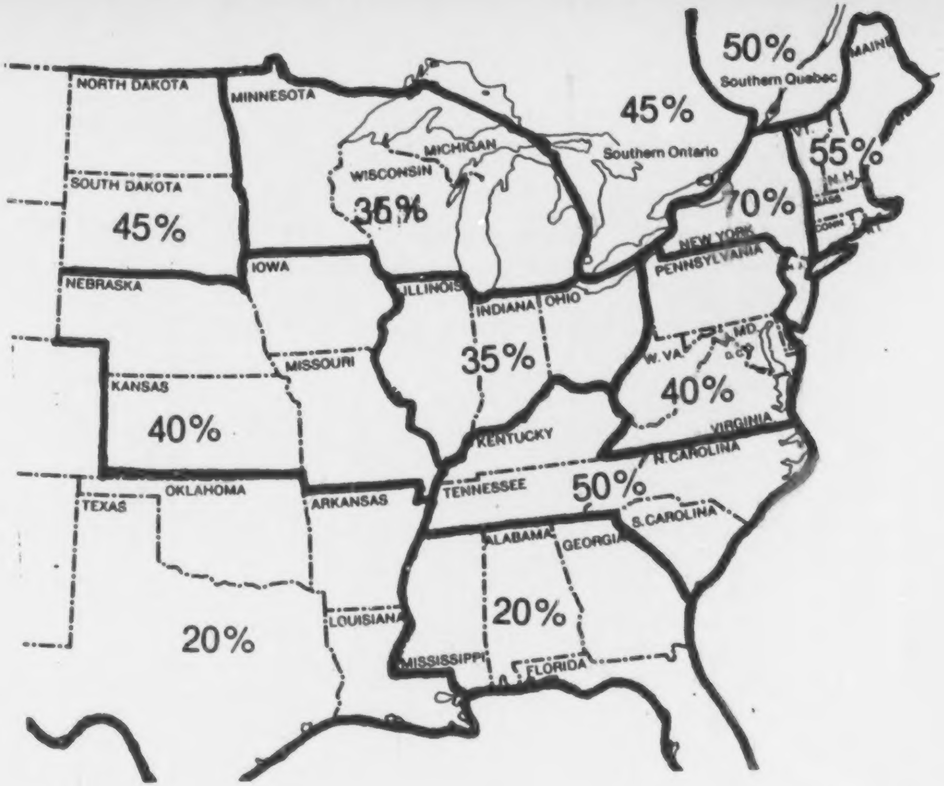

50%
Southern Quebec
MAINE
45%
Southern Ontario
VT.
55%
N.H.
MASS.
CONN.
R.I.
70%
NEW YORK
PENNSYLVANIA
NORTH DAKOTA
MINNESOTA
MICHIGAN
WISCONSIN
35%
SOUTH DAKOTA
45%
IOWA
NEBRASKA
ILLINOIS
INDIANA
OHIO
35%
MD.
D.C.
W. VA.
40%
VIRGINIA
MISSOURI
KANSAS
40%
KENTUCKY
N. CAROLINA
TENNESSEE
50%
OKLAHOMA
TEXAS
ARKANSAS
S. CAROLINA
ALABAMA
GEORGIA
20%
LOUISIANA
20%
MISSISSIPPI
FLORIDA

Figure 5.—Percent of Total Deposited Sulfur Coming From Outside Region

SOURCE: SRI and EPA, 1981.

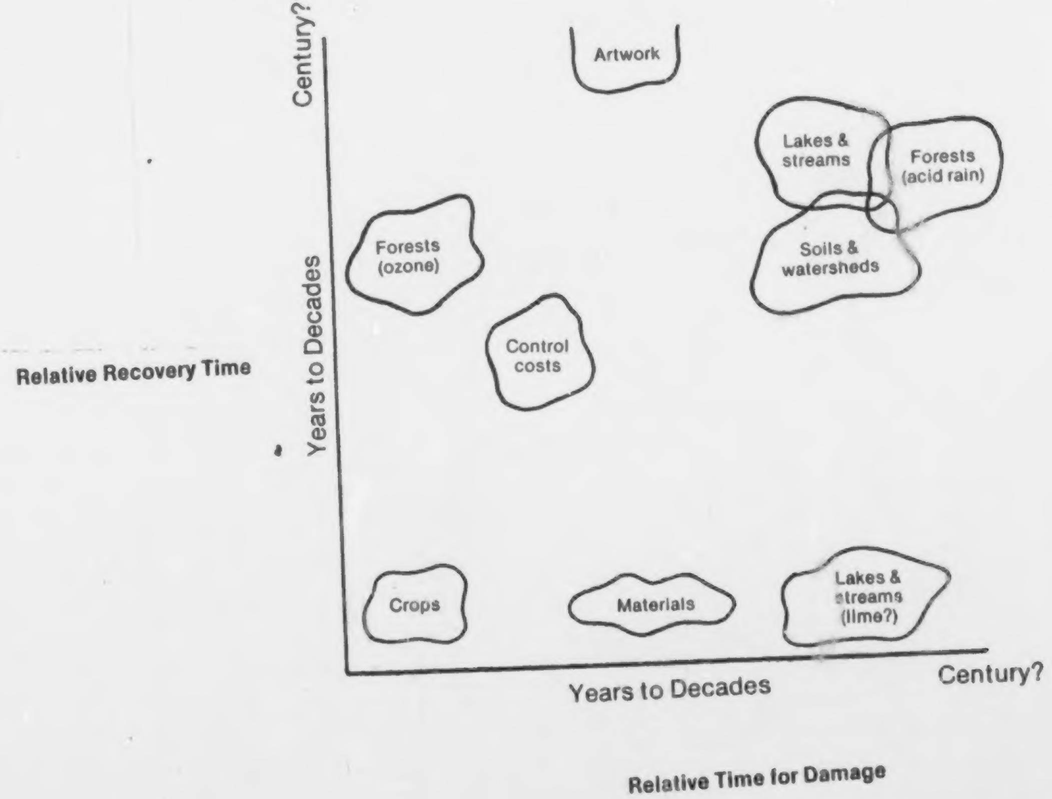

Century?
Years to Decades
Relative Recovery Time
Artwork
Lakes & streams
Forests (acid rain)
Soils & watersheds
Forests (ozone)
Control costs
Crops
Materials
Lakes & streams (lime?)
Years to Decades
Century?
Relative Time for Damage

Figure 6

SOURCE: Office of Technology Assessment.

TESTIMONY OF RICHARD KLEIN BEFORE THE SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS. RANDOLPH, VT. 30 June 1981

Mr. Chairman,

My name is Richard Klein. For identification purposes, I am professor of botany at the University of Vermont. My education and research relate to questions on how plants grow. Together with Professor H.W. Vogelmann, an ecologist in the Botany Department of the University of Vermont, we have for several years had a major research project on acid rain with financial support from the Vermont Agricultural Experiment Station, the U.S. Forest Service and the American Electric Power Service Corporation.

At the outset, I must indicate as strongly as possible that our researches have not yet provided definitive answers relating to the possible responses of biological and ecological systems to acidic rains. Indeed, no research we know about has such answers. Our ~~particular~~ research thrust focuses on terrestrial ecosystems with particular emphasis on the plants growing on Vermont mountains. We have not ourselves studied these matters in agricultural lands or in ponds, lakes and streams. I will, therefore, restrict my testimony to the factual information which we have obtained and include other information made available by other research units.

Our first question was whether the precipitation in Vermont is significantly acidic. The answer, based on extensive monitoring of precipitation on Camels Hump and Madonna mountains and at Botany's Proctor Maple Research Farm in Underhill, is yes. Over the non-freezing period, the average acidity (pH) value of rain is 3.8, approximately 100 times more acidic than "pure" rain. The fog that condenses on leaves and needles are an important water source for Vermont's mountains and watersheds is also acidic, with pH values between 3.4 and 3.7. While these values are are close to those of rain, the fog water is, at higher elevations, much copious than that of rain so that the total acid load reaching the forests of spruce and fir is greater than that reaching lower elevations. Snow, and the rime ice that condenses from fog, are also acidic with averages of pH 4.4 and 4.1 respectively. The values we are obtaining in Vermont are not untypical of those reported elsewhere in upper New England.

The chemical composition of the acids in precipitation has been determined. They are primarily sulfuric and nitric acids derived from sulfur dioxide and nitrogen oxides. At lower elevations of Madonna Mountain - up to about 3000 feet, the ratios of sulfate to nitrate are close to 2.0 and 2.4 in both rain and fog, i.e., there is twice as much sulfuric as nitric acid. At upper elevations, however, the ratio rises in rain and is lower in fog water; fog tends to be somewhat enriched in nitric acid. These ratios are not constant, varying with the period of collection, but overall the values we have determined are, again, not untypical of other areas in New England and the Adirondack Mountains of New York.

These two acids account for most of the acidity in our precipitations, but there are small amounts of other acidic or even alkaline components present whose chemical composition is presently unknown. The acidic components we have measured are those dissolved in precipitation; there are, based on studies done elsewhere, significant inputs of acidic substances in dry fallouts that eventually are washed off foliage into the soils. The concentration of these additional acidic substances is not well known.

There are other chemicals in precipitation that enter our evaluations. We have found that several heavy metals are present in rain and fog and have data showing that copper, lead and zinc are present in measurable quantities.

Monitoring activities have also been conducted on the plants of Vermont mountains. In the 1960's a complete study of Camels Hump was made as a

Ph.D. thesis in Botany. Two things are important about this study. First, it was done with no thought of acid rain research - it is one of many examples of the potential importance of basic scientific research which, sometimes many years later, proves to be invaluable. In this instances, because of this research, the Botany project has a data base unmatched in North America that allows us to make comparative evaluations of changes over a significant time period. Equally important, the conifer zone of Camels Hump is a protected Ecological Zone, unique for its ecology, elevation and aspect and in the fact that it has not and must not be used for other than research. Economic exploitation, not only of the upper elevations, but also of the lower, not yet protected, face of this mountain will destroy for all times an irreplaceable research tool for acid-rain and many other ecological investigations.

The ecological survey of the 1960's was completely and precisely repeated in 1979, the data sets computerized and each plant species and each elevation compared for possible changes in numbers, area of land surface covered by each species, growth and other potentially-important parameters that might relate to the acid-rain research project.

We have paid particular attention to the tree species since they are of basic esthetic, ecological and environmental importance not only on the mountains, but for the entire watershed. On most New England mountains there is a well-marked zonation of ecosystems. Below about 2400 feet elevation the forests are primarily hardwood species - maple, beech, etc. Between 2400 and about 2600 foot elevation the forests are in transition from the hardwoods to softwood conifers and, above 2600 feet, the forests are dominated by red spruce and balsam fir. This is the boreal forest that extends both north and south of Vermont.

Three ecological measurements are used to evaluate forest dynamics of trees. The first is density, that is how many trees are there per unit area. The second is basal area, that is how much of a unit area is covered by each tree species. The third measure is the range of stem diameters from which various size classes of trees can be determined. We have used all these measurements and I will present the percentage changes that have occurred between the 1965 original ecological study and our restudy in 1979.

The most striking change in tree species was found in red spruce. In the boreal forest, upper elevation zone on Camels Hump, the density of small, medium and large sized spruces decreased markedly with the greatest decrease, close to 50%, found among the larger trees, those of 10 cm or greater diameter. This decrease in stand density was paralleled by decreases in the basal areas covered by red spruce. We can say with considerable assurrance that there has been death and decreased growth of this important tree species.

Red spruce is not the only species showing changes in the 1965-1979 period. Balsam fir, the other major conifer in the boreal zone, is increasing with the younger trees showing the greatest increase. White birch, a third major species of the boreal forest, is also increasing. It is possible that as the spruce dies, the competition for soil, water, light, nutrients and space is altered and that these other trees are taking over the sites formerly occupied by the spruce. Thus, while the forests may remain, their composition - reflected in many ecological interactions - will be vastly different. Comparative studies on Mt. Abraham, Bolton Mountain and Jay peak have given the same results and observations in the Adirondacks, in other areas of upper New England and as far south as New Jersey parallel our findings in Vermont. Red spruce decline is real. Spruce decline and dieback is also occurring in Germany, Canada and possibly other areas of the world.

In the hardwood zone on Camels Hump, both sugar maple and beech are decreasing in stand density and basal areas and yellow birch is decreasing in density, but not in basal area. Although the percentage changes in these hardwoods are not as dramatic as for spruce, they demonstrate real alterations that may eventually result in ecological changes in forest composition.

Knowing that there are important alterations in the forest composition on Vermont's and other mountains, led us to the development of research studies on the reasons for these changes. I re-emphasize that only because we had the data base for Camels Hump could we focus our experimental designs on causal factors, and that we are able to conduct laboratory simulation experiments and then evaluate them on the unique study area of Camels Hump.

Our finding, substantiated by reports from European and North American laboratories, that there are significant quantities of heavy metals in precipitation, led to a study of the presence of these heavy metals in soils of Camels Hump. On the average, the lead concentration in the soils increased by almost 90%, zinc by 70% and copper by 40% between 1965 and 1980. Aluminum, normally present in our mountain soils in insoluble and hence non-available and non-mobile forms, may also have become more soluble as reported by other groups in North America and Europe. Dr. Schofield of Cornell University, for example, believes that the large increases in the aluminum concentration in lakes is due to its solubilization in soils receiving acid loads from rain and snow and that this is a major factor in the widely-observed killing of fish and other aquatic wildlife. We are actively studying, at both laboratory and field levels, whether these concentrations of heavy metals now in the soil play a causal role in the alterations we have found in plant development.

In the 1965-1980 period, there has also been a marked increased in the amount of organic matter in our maintain soils. Put simply, the leaves and needles that fall from trees are not breaking down into humus as rapidly as they did prior to our period of study. This can mean that the recycling of nutrients --nitrogen, phosphorus, calcium and potassium -- back into living plants is reduced. This is now under study by our research group where we are measuring the leaching of spruce and fir needles by acidic precipitation, the activity of the microorganisms that decompose them, and the decomposition of the cellulose that makes up the humus in soil. We now know that the combination of acidity and heavy metals does depress this important decomposition process.

We have also found that acidity of laboratory-made fogs increases the leaching of nutrients, sugars and even proteins from living spruce and birch trees. Whether this foliar leaching significantly deprives trees of necessary chemicals is under study.

At the laboratory simulation level, we also know that the combination of acidity and heavy metals interferes with the development of a variety of soil microorganisms including nitrogen-fixing bacteria and blue-green algae, the fungi that form nutrient-gathering associations with tree roots (mycorrhizal associations), and mosses.

We, and other laboratories here and abroad, have investigated the obvious question of whether the alterations in forest composition resulting from spruce decline might be due to insect infestations or to disease. The forest pathologist in the School of Natural Resources at the University of Vermont has not been able to find such infestations or diseases.

Studies by our group and others on a variety of aspects of the acid-rain research ~~is~~ are still under way. Soils, soil microorganisms, interactions among these ecosystem components and higher plants have, to date, shown that precipitation does contain chemicals that can affect various parts of terrestrial ecosystems. The major question - indeed, the primary objective of our research - is whether there is a cause and effect relationship between the fact that precipitation is acidic and contains heavy metals and the fact that there are quantitatively-measureable alterations in the growth, productivity and viability of plants, including trees, growing in mountainous areas of Vermont and other locations in New England, Canada and Europe. As professional scientists, we ~~cannot~~

are unable at the present stage of research, to make this correlation. No research group in the world can answer this question at this time. It must also be emphasized that our inability to state that there is a correlation between acidic precipitation and alterations in terrestrial ecosystems does not mean that acid-rain and the accompanying pollutions with heavy metals is not a causal factor. We are, however, confidant that the multi-faceted approach involving integrated laboratory and field research now in progress in the Botany Department of the University of Vermont and elsewhere is the only way this important question can be answered.

TREES ON CAMELS HUMP MOUNTAIN IN VERMONT

PERCENTAGE CHANGES BETWEEN 1965 AND 1979

GROWTH ZONES	TREE SPECIES	BASAL AREAS	DBH cm.	DENSITY
HARDWOOD 1800' - 2400'	Sugar Maple	-16%		-20%
	Beech	-30%		-39%
	Yellow Birch	-29%		+22%
	Red Spruce	-40%		-15%
TRANSITION 2600' - 2800'	Red Spruce	-41%		
BOREAL	Red Spruce	-45%	-2.0	-32%
			2.0-9.9	-28%
			10.0+	-52%
	Balsam Fir	-8%	-2.0	+158%
			2.0-9.9	+9%
			10.0+	+21%
	White Birch	-22%	-2.0	-32%
			2.0-9.9	+262%
			10.0+	0

RED SPRUCE ON FOUR MOUNTAINS IN VERMONT

PERCENTAGE CHANGES BETWEEN 1965 and 1979

MOUNTAIN	TREE DENSITY # stems/HA*	TREE BASAL AREA m^2/HA
Camels Hump	-52%	-44%
Mt. Abraham	-60%	-26%
Bolton Mountain	-77%	-25%
Jay Peak	-78%	-61%
Averages	-67%	-39%

* stems with diameters of 10 cm or greater

SOILS ON CAMELS HUMP MOUNTAIN IN VERMONT

PERCENTAGE CHANGES BETWEEN 1965 and 1980

GROWTH ZONES	ORGANIC MATTER	LEAD	ZINC	COPPER
HARDWOOD 1800' - 2400'	+53%	+57%	+60%	+37%
TRANSITION 2600' - 2800'	+82%	+107%	+113%	+52%
BOREAL 3000' - 3800'	+61%	+98%	+44%	+30%

STATEMENT OF DR. E. ALAN CASSELL, PROFESSOR OF WATER RESOURCES, DIRECTOR, VERMONT WATER RESOURCES RESEARCH CENTER, SCHOOL OF NATURAL RESOURCES, UNIVERSITY OF VERMONT

Dr. E. Alan Cassell
Professor of Water Resources
Director, Vermont Water Resources Research Center
School of Natural Resources
University of Vermont

Resources at the University of Vermont (UVM), our State's Land Grant University. I am also Director of the Vermont Water Resources Research Center - a cooperative state/federal funded activity at UVM with a mission to encourage and carry-out research on water resource problems that have high priority to the State of Vermont. I am delighted to have this opportunity to share my views and knowledge on acid precipitation and atmospheric deposition with the Committee.

(1) First, I intend to briefly describe a recently completed effort in which the Water Resources Research Center in Vermont and other New England states identified the major water resource related issues whose solution depends on well-focused research activities. As might be expected, acid precipitation emerged as one of the concerns in greatest need of research.

(2) Second, I plan to summarize another piece of work that was recently completed by Professor John R. Donnelly and Mr. Robert S. MacGregor of the University of Vermont. Their research entitled "Assessment of Sites In Vermont For Their Susceptibility To Acid Rain" takes us about as far as is now possible, without further research, in making assessments, based on scientific knowledge regarding impacts of acid precipitation. I am summarizing this work at Professor Donnelly's request since he was unable to participate in these hearings.

In support of this testimony I submit, for the record, the following three publications:

(1) Long, M.F. & Cassell, E.A., "Vermont Water Resources Research Center Five Year Plan For Water Resources Research and Development" Vermont Water Resources Research Center, School of Natural Resources, University of Vermont, Burlington, Vermont (October 1980).

(2) Hasbrouck, S.S., "Water Resources Research Needs In New England" New England Council of Water Center Directors, Boston, Ma. (November 1980).

(3) Donnelly, J.R. & MacGregor, R.S., "Assessment of Sites In Vermont For Their Susceptibility To Acid Rain: Final Report" School of Natural Resources, University of Vermont, Burlington, Vt. (March 1981).

II

WATER RESOURCES RESEARCH NEEDS

In 1979, the U.S. Congress instructed the state water resources research centers to assist in carrying out a national assessment of water resources research needs. The purpose of this effort was to establish a basis for focusing federal investments in water research on topics of highest need and priority. The assessment was conducted first on a state-by-state basis, with the results combined into regional reports, and finally a national assessment was to be prepared. This activity was completed during the late fall of 1980.

Research Needs in Vermont. The Vermont Water Resources Research Center has developed a priority listing of research most needed by Vermont to solve its existing and emerging water resource problems. This priority listing is described in great detail in the first publication submitted for the record along with this testimony (Long & Cassell-1980).

Vermont is an essentially rural state of 9,609 square miles with a population of about 511,000 and average annual precipitation of 42 inches. It is a state in which small towns, small businesses, and small watersheds predominate. Although Chittenden County in northwestern Vermont is an area of relatively concentrated development, Vermont in most respects is decentralized both culturally and hydrologically. Generally, the absence of large scale urbanization is perceived as an asset both because tourism is an important industry and because Vermonters value the rolling forest and farmland, and the mountains, lakes, and streams which make their state what it is.

However, for the water resources manager, the decentralized nature of the water resource evident in Vermont's many discrete watersheds and groundwater aquifers presents difficult problems for water resource managers through the economic limitations which impinge on the ability of small rural communities to provide adequate facilities for water supply and wastewater treatment. Furthermore, Vermont's water resources face serious threats from sources over which Vermont at present has little if any control. These include population and economic growth within the State as well as regional and national problems such as acid precipitation and toxic and hazardous materials management.

In the development of these research needs, a state-wide desire to maintain Vermont's rural character despite the threat of degradation from a variety of existing and potential sources has emerged as a major concern. However, population growth, increasingly intense private development of sensitive areas, and the advent of in-State water resource problems whose origins are outside of the State all make it uncertain whether existing management programs will be sufficient to allay degradation of Vermont's water resources and its landscape. The traditional management approach of minimizing adverse impacts may not be enough in a State where environmental values are especially important, where the pressures of development are increasingly severe, and where water resource problems are already raising questions with no easy answers.

In order to establish appropriate research priorities it was first necessary to identify the most important water resource management problems and then to target those whose solution could most productively be accomplished or assisted by research. Water and national resource managers from local, state and federal agencies and recognized researchers were canvassed in several ways to identify (a) the most important management problems and (b)those that research that could best help solve management problems.

Specifically, these individuals were asked to rate the eleven most highly recognized water resource management problems as either being a critical problem, an important one or a management problem of low priority. These results are summarized in Table 1.

Table 1
Severity of Water Resource Management Problems

	Critical*	Important*	Low Priority*	Rank**
Ground Water	60.9%	39.1%	0.0%	1
Toxic Waste	47.8%	52.2%	0.0%	2
Wastewater Treatment	43.5%	56.5%	0.0%	3
Data Base	45.8%	50.0%	4.2%	4
Allocation Issues	52.2%	30.4%	17.4%	5
Lake Management	34.8%	65.2%	0.0%	6
Hydropower Development	41.7%	50.0%	8.3%	7
Land Runoff	31.8%	59.1%	9.1%	8
Wetlands	33.3%	54.2%	12.5%	9
Acid Precipitation	26.1%	65.2%	8.7%	10
Drinking Water	26.1%	60.9%	13.0%	11

*% of responses **as assigned by Long & Cassell-1983

When these same individuals were asked whether each of these eleven management problems could best be solved through: (a) more vigorous pursuit of existing policy; (b) implementation of new policy; (c) research; (d) some other avenue; or (e) some combination of the above -- the following percentages of respondents indicated that research would be necessary for solving the problems indicated (see Table 2).

Table 2
Water Resource Management Problems Needing Research

		Rank
Acid Precipitation	86.9%	1
Ground Water	85.0%	2
Data Base	73.8%	3
Toxic Waste	57.2%	4
Wastewater Treatment	47.7%	5
Allocation Issues	45.4%	6
Lake Management	45.0%	7
Land Runoff	38.2%	8
Hydropower Development	36.4%	9
Wetlands	34.7%	10
Drinking Water	14.3%	11

Not surprisingly, the data presented in Table 2 suggest that research is most severely needed in areas like acid precipitation and ground water where little has been done in the past and where the potential damage from neglect of the problem could be extreme. However, as Table 1 indicates, acid precipitation is not presently perceived as one of Vermont's most critical problems, whereas wastewater treatment, the science of which is already well developed, continues nevertheless to be among the most critical problems of Vermont's water resources.

It is recognized that future damage caused by acid precipitation could be severe. It is also recognized that precious little knowledge exists upon which to base rational solutions to this interstate air/water quality problem. Research is needed now even though major impacts may not be evident even within the next decade. It is not enough to say that research is needed to help solve problems associated with acid precipitation. More specifically as stated by Long & Cassell (1980).

> "New England's location downwind of major midwestern industrial centers results in highly acid precipitation routinely falling throughout Vermont and the rest of the New England region. Although acid precipitation is

known to cause serious problems in certain lake ecosystems and is thought to reduce forest productivity, impacts on soils, agriculture, and other terrestrial ecosystems are largely unknown. Vermont realizes that the root cause of acid precipitation can be controlled only through management programs at the interstate or national levels; however, limited knowledge on the effects of acid precipitation throughout Vermont can severely restrict the State's ability to effectively participate in multi-state and national efforts for managing this problem. Specifically, research is needed in Vermont:

(1) To determine what impacts acid precipitation has on Vermont's terrestrial and aquatic ecosystems. Research concerns should extend beyond those of SO_4, NO_3 and pH to include P and heavy metals. Considerable attention needs to be directed toward Vermont's special environmentally sensitive areas.

Furthermore, a regional research effort would be appropriate:

(1) To evaluate the economic, social, and health implications of long-term continuation of acid precipitation over the New England region.

(2) To explore legislative and other institutional mechanisms for controlling the problem at its source."

Research Needs In New England. As pointed out by Hasbrouck (1980):

"The research needs of each state in the region are to some extent unique,... There is general agreement that at present most of the serious problems in the region have to do with water quality rather than water quantity. However, increased problems related to allocation of limited resources among competing uses are anticipated, and research needs in this area are expected to increase, particularly in the institutional aspects of resource management."

The following list of regional water resources research needs were identified by Hasbrouck (1980) (i.e. not listed in priority order):

1. Groundwater Protection/Hazardous Wastes
2. Acid Precipitation
3. Runoff & Degradation of Lakes & Streams
4. Recreation & Protection of Natural Habitats
5. Institutional Coordination
6. Regional Allocation of Water Resources
7. Water Resources & Tourism

More specifically the regional research needs relating to acid precipitation were identified as:

> "There is a general regional need to better understand the historic -- and projected -- changes in acidic levels of rain, snow, and dry deposition. Research is desired on how changing acidity levels of precipitation have been and will be reflected in the chemistry of surface waters, groundwaters, and soils of the region. And research is desired on the effects of such chemical changes on terrestrial and aquatic life, particularly (1) on coldwater and anadromous fish species in lakes and streams; (2) on micro-organisms and insects in terrestrial and quatic systems; (3) on soil processes including decomposition and nitrogen fixation; and (4) on vegetative growth, especially of trees. This research is particularly important to the northern tier states because their elevated lakes and extensive forests are of such major social and economic importance and also because those lakes and forests appear to be particularly vulnerable to changes in acid levels. The phenomena to be studied should include not only the direct effects of changing acidity, but also those associated with the release of heavy metals and other substances from soils and sediments. There is also a regional dimension to the acid precipitation problem which goes beyond the assessment of effects on precipitation, surface waters, soils, and ecosystems in any particular state. The air masses that bring acid precipitation to New England affect all of the states. And the causes of the acid precipitation, being located for the most part outside the region, can be controlled only at interstate and national levels. For these reasons, a regional research effort would be appropriate (1) to project the future regional pattern of acid precipitation; (2) to evaluate the economic, social, and health implications of long-term continuation of acid precipitation over the New England Region; and (3) to explore legislative and other institutional mechanisms for controlling the problem at its source" (Hasbrouck 1980).

III

ASSESSMENT OF SITES IN VERMONT FOR THEIR SUSCEPTIBILITY TO ACID RAIN

It is my intent at this point to try to summarize those findings of Donnelly & MacGregor (1981). As mentioned earlier I do so at Professor Donnelly's request as a previous engagement made it impossible for him to participate in these Hearings. Their detailed findings have been submitted to become part of the record for these Hearings.

The purpose of their work was to identify criteria by which the various agricultural, forest and aquatic ecosystems in Vermont could be rated in terms of their susceptibility to acid precipitation and to utilize these criteria in developing maps outlining susceptible areas in the Vermont counties of Bennington and Franklin. These two counties represent extremes in the range of lake water pH and were thought to best represent the extremes of acid rain susceptibilities in the state.

The major problem with acid precipitation was generally considered to stem from the acidifying effects that H_2SO_4, HNO_3, and HCl have on various components within the ecosystem. Therefore, an ecosystem's resistance to acid precipitation can be evaluated primarily on its ab ility to prevent and/or to tolerate significant reductions in pH. That was the major criterion used in assessing ecosystem susceptibility in the work of Donnelly & MacGregor (1981).

In addition, assessment of ecosystem susceptibility must consider other compounds contained in precipitation or made soluble in soils, or sediments by low pH which, individually or in conjunction with low pH, may adversely affect the environment. Especially significant are metals such as lead, arsenic or aluminium which, when combined with low pH, may pose ecological threats ranging from decreased plant growth and fish mortality to human health hazards.

An accurate representation of ecosystem susceptibility to acid precipitation must include a number of variables. Donnelly & MacGregor (1981) developed integrated susceptibility maps for both aquatic and terrestrial ecosystems in Franklin and Bennington Counties based on the combined effects of geology, soils, land use, and precipitation. To do this, they first gridded Franklin and Bennington County maps into ¼-inch squares (1 square mile of actual land surface). Then, they recorded the geology, soils, precipitation, and land-use characteristics of each square.

Individual susceptibility values were assigned to soil, bedrock and land-use in each gridded square on the basis of literature derived information. Values for precipitation were arbitarily developed to appropriately emphasize the range in precipitation within the state. For aquatic ecosystems geology was interpreted to be the dominant susceptibility factor because of the pre-eminant effect a limestone or granite bedrock has on the pH of water bodies in the area. Areas underlain by bedrock with low buffering capacity were assigned a geologic rating of 2.0. Areas with bedrock of low/moderate buffering capacity were assigned a geologic rating of 1.0. And areas with bedrock having a high buffering capacity were assigned a geologic rating of 0.0; these areas were considered to have low susceptibility regardless of soil characteristics, precipitation, or land cover. Next, each square having a geologically low or low/moderate buffering capacity was rated according to its soil type: 2.0 points for sensitive soils, 1.0 point for a slightly sensitive soil, and 0.0 points for non-sensitive soils. Precipitation ratings, based on yearly average precipitation, were then assigned to these squares: 2.0 points for areas with 55 inches or more; 1.0 point for areas with 41-45 inches; and 0.0 ppints for areas receiving 40 inches or less. Finally, they assigned land-use ratings: 2.0 points for coniferous forests, 1.0 points for mixed or hardwood forests, and 0.0 points for all other land-use categories.

An estimate of the"integrated susceptibility" was then obtained for each gridded square by summing the individual susceptibility values. Areas with 5.0 or more points, out of a possible total of 8.0, were rated as having relative high susceptibility. Areas with 3.0 or 4.0 points have moderate/high susceptibility. Areas with 1.0 or 2.0 points have low/moderate susceptibility and areas with 0.0 points (highly buffered bedrock) have low susceptibility. Based on these criteria, maps of integrated susceptibility were then prepared for Franklin County and Bennington County.

The results of the mapping/gridding procedure described above are quoted from Donnelly & MacGregor's (1981):

"The Champlain Valley in western Franlin County is underlain by limestone and dolostone and therefore its aquatic ecosystems have a low susceptibility to modification by acid precipitation (Figure 1). Low susceptibility regions in Bennington County are restricted to the Marble Valley adjacent of U.S. Route 7 (Figure 2). The central section of Franklin County is dominated by areas of low/moderate susceptibility (Figure 1); this region is underlain with shales, receives low precipitation, has well-buffered soils, and consists largely of agricultural lands. Similar conditions exist in a small section in the south-west corner of Bennington County (Figure 2). The eastern hills section of Franklin County has moderate/high susceptibility (Figure 1); aqueous ecosystems in this area are considered to be more susceptible because of higher precipitation and because land use changes from predominantly agriculture to predominately forest. There are two distinct areas of moderate/high susceptibility in Bennington County (Figure 2). One is in the Teconic Mountains in the County's northwestern corner; this area has slate bedrock, deciduous and mixed forests, and slightly sensitive, low nutrient soils. The other areas of moderate/high susceptibility in Bennington County are on the lower slopes of the Green Mountains (Figure 2); they have poorly-buffered bedrock, receive moderate precipitation, and are generally forested. No high susceptibility areas are found in Franklin County. High susceptibioity areqas in Bennington County are restricted to the upper elevations of the Green Mountains (Figure 2). The high susceptibility ratings of aqueous ecosystems in this area are due to highly-resistant bedrock, coniferous forest vegetation, and high precipitation. These areas would probably be the first harmed by continuing acid precipitation.

It is interesting to note that the distribution of aquatic ecosystem susceptibility classes, as presented in Figures 1 and 2, are similar to the distribution of pH classes in selected lakes within the two counties as recorded by the Vermont Department of Water Resources (1980); areas of high susceptibility tend to have the lowest pH. This similarity is especially noteworthy for Bennington County, and supports the general accuracy of our procedures for assigning aquatic ecosystem susceptibility.

The same four factors (geology, soils, precipitation, and land-use) were used to assess terrestrial ecosystem susceptibility. However, different relative weights were assigned to some of these factors. Soil characteristics and precipitation were rated the same as for aquatic ecosystems. But geology was considered to be less important than with aquatic ecosystems. Areas underlain by bedrock with low buffering capacity were assigned a geologic rating of 1.0 (rather than 2.0). Areas with bedrock of low/moderate buffering capacity were assigned a geologic rating of 0.5 and, as with aquatic ecosystems, areas of bedrock with high buffering capacity were assigned a rating of 0.0. In contrast to the classification system used in rating aquatic ecosystems, soil, precipitation, and land-use characteristics were considered in rating terrestrial ecosystems even though the area contianed highly-buffered bedrock. In rating the land-use factor, coniferous, deciduous, or mixed forests were assigned the value of 1.0; all other categories were assigned the value 0.0. Areas with 4.5 or more total points (out of a possible total of 6.0) were considered to have susceptibility. Areas with 2.5 to 4.0 points have moderate/high susceptibility. Areas with 1.0 to 2.0 points have low/moderate susceptibility; and areas with 0.0 or 0.5 points have low susceptibility.

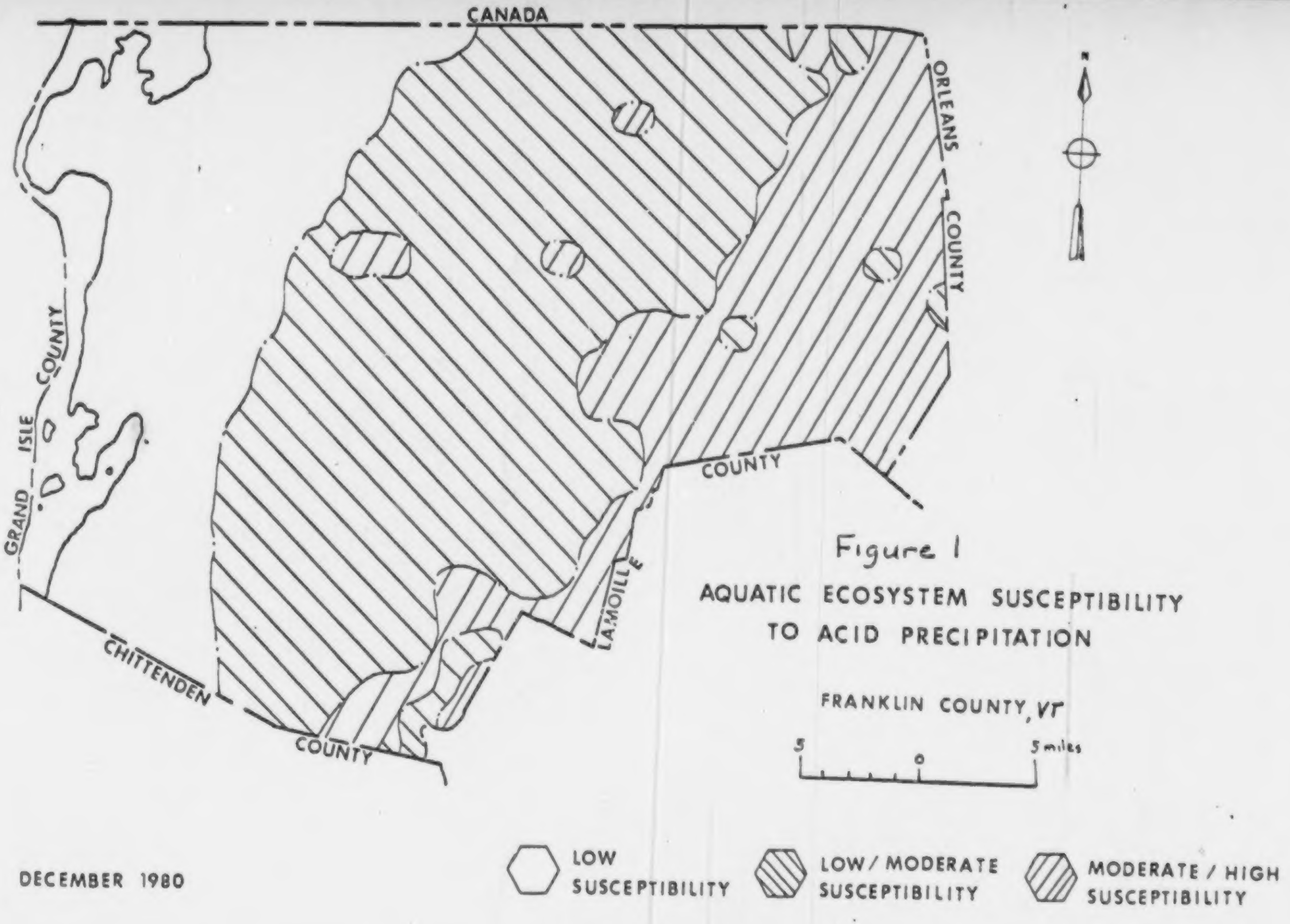

CANADA
ORLEANS COUNTY
GRAND ISLE COUNTY
CHITTENDEN COUNTY
LAMOILLE COUNTY
5
0
5 miles
LOW SUSCEPTIBILITY
LOW/MODERATE SUSCEPTIBILITY
MODERATE / HIGH SUSCEPTIBILITY

Figure 1

AQUATIC ECOSYSTEM SUSCEPTIBILITY TO ACID PRECIPITATION

FRANKLIN COUNTY, VT

DECEMBER 1980

- from Donnelly & MacGregor (1981)

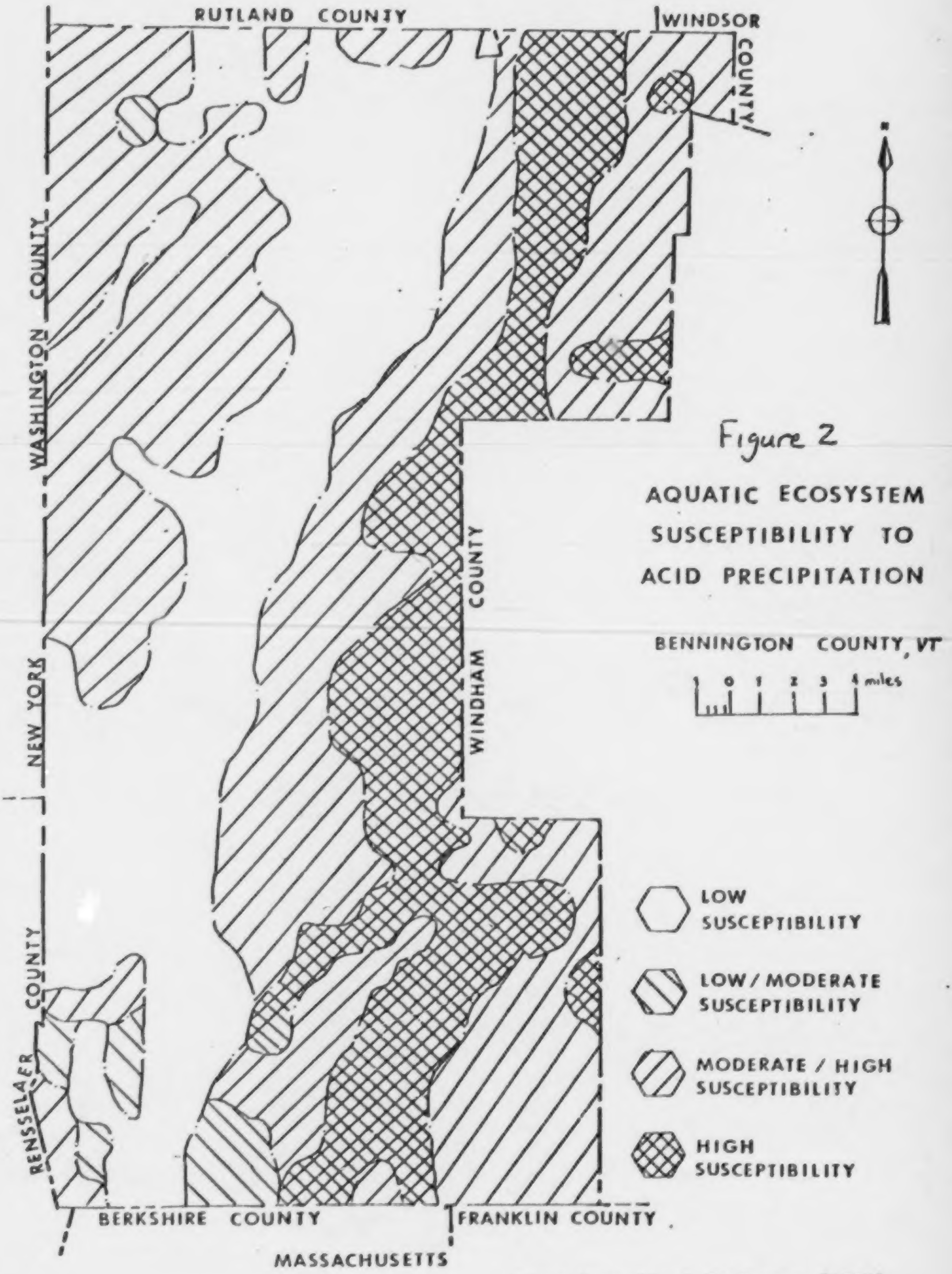

RUTLAND COUNTY
WINDSOR COUNTY
WASHINGTON COUNTY
NEW YORK
RENSSELAER COUNTY
WINDHAM COUNTY
BERKSHIRE COUNTY
FRANKLIN COUNTY
MASSACHUSETTS
1 0 1 2 3 4 miles
LOW SUSCEPTIBILITY
LOW / MODERATE SUSCEPTIBILITY
MODERATE / HIGH SUSCEPTIBILITY
HIGH SUSCEPTIBILITY

Figure 2

AQUATIC ECOSYSTEM SUSCEPTIBILITY TO ACID PRECIPITATION

BENNINGTON COUNTY, VT

- from Donnelly & MacGregor (1981)

DECEMBER 1980

Based on this classification system, the western three-fourths of Franklin County are intermixed with regions of low and low/moderate terrestrial ecosystem susceptibility (Figure 3). Low and low/moderate susceptibility areas in Bennington County are restricted to the Marble Valley adjacent to U.S. Route 7 (Figure 4). In Franklin County, moderate/high susceptibility areas are found in eastern hills region (Figure 3). Moderate/high susceptibility areas are found throughout the Teconic Mountain and almost all of the Green Mountain regions of Bennington County (Figure 4).

We are less confident of the accuracy of our terrestrial ecosystem maps than we were of aquatic ecosystem maps. For one thing, depending upon soil depth, bedrock geology may or may not have an important impact on the sensitivity of terrestrial ecosystems. And we have little real knowledge of the sensitivities of the various plant species. Therefore, even though out system for classifying terrestrial ecosystems is based on the best information currently available, it may have to be modified when additional data become available." (Figure numbers in above quote have been changed to permit clarity in this testimony).

In addition, the conclusions offered by Donnelly & MacGregor (1981) were:

"1. Precipitation in Vermont, as well as that in much of the northeastern U.S., is acidic with a pH of approximately 4.0 to 4.5.

2. Higher elevations of the state probably receive greater yearly amounts of acid inputs because they receive substantially more precipitation than do lower elevations.

3. The sensitivity of ecosystems, especially aquatic ecosystems, to modification by acid precipitation is affected by local soils and geology. Drainage areas with granitic bedrock are poorly buffered and are therefore sensitive to modification by acid precipitation; ecosystems underlain with limestone are well buffered and resist pH changes. Soil sensitivity is considered to be a function of cation-exchange-capacity (CEC). Soils with a high CEC resist changes in pH whereas those with a low CEC are sensitive to acid-induced pH changes.

4. Integrated maps of terrestrial and aquatic ecosystem susceptibility, based on precipitation amount, soil CEC, geologic formation, and land cover type, were developed for Franklin and Bennington Counties. Highest susceptibilities were generally found in the upper elevations of each county.

5. Aquatic ecosystems in high elevation lakes draining small watersheds with granitic bedrock and shallow, acidic soils are probably most susceptible to significant reductions in pH. This may result in population reductions and/or alterations in the species composition of fish and other aquatic organisms.

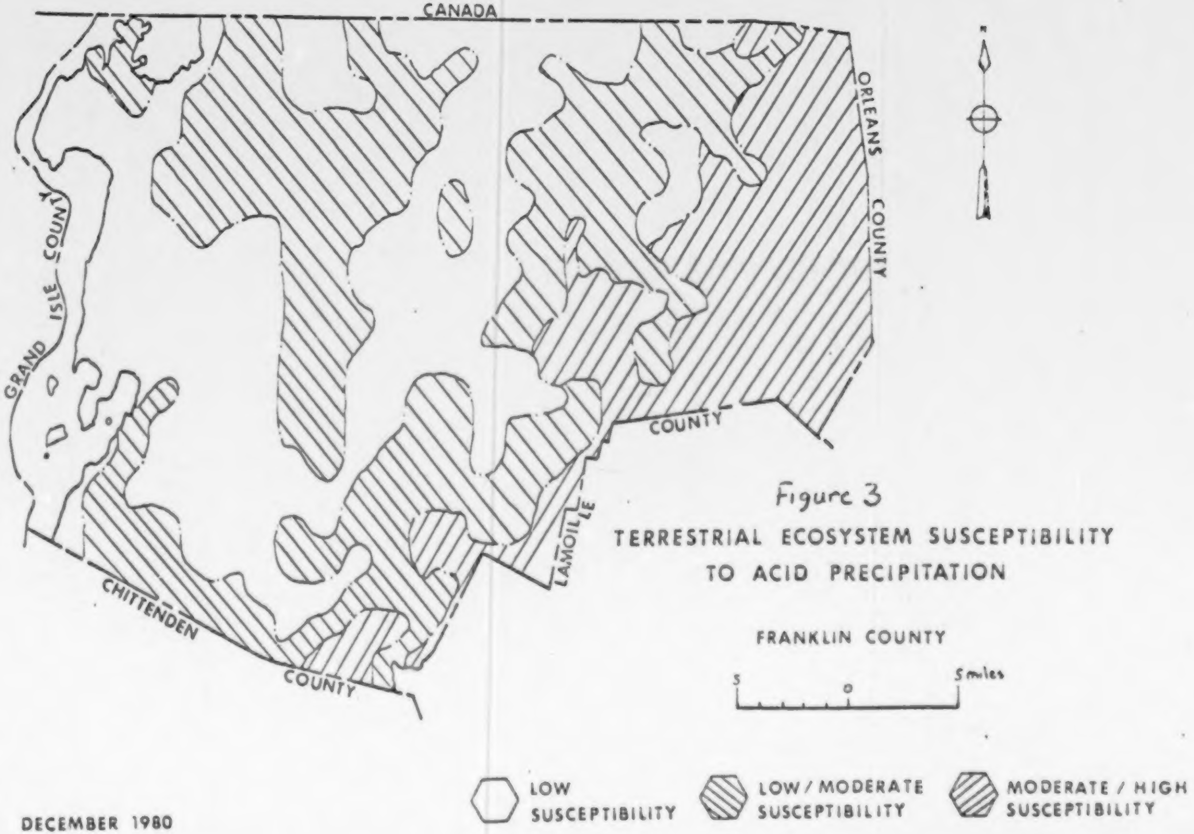

CANADA
ORLEANS COUNTY
LAMOILLE COUNTY
CHITTENDEN COUNTY
GRAND ISLE COUNTY
5
0
5 miles
LOW SUSCEPTIBILITY
LOW / MODERATE SUSCEPTIBILITY
MODERATE / HIGH SUSCEPTIBILITY

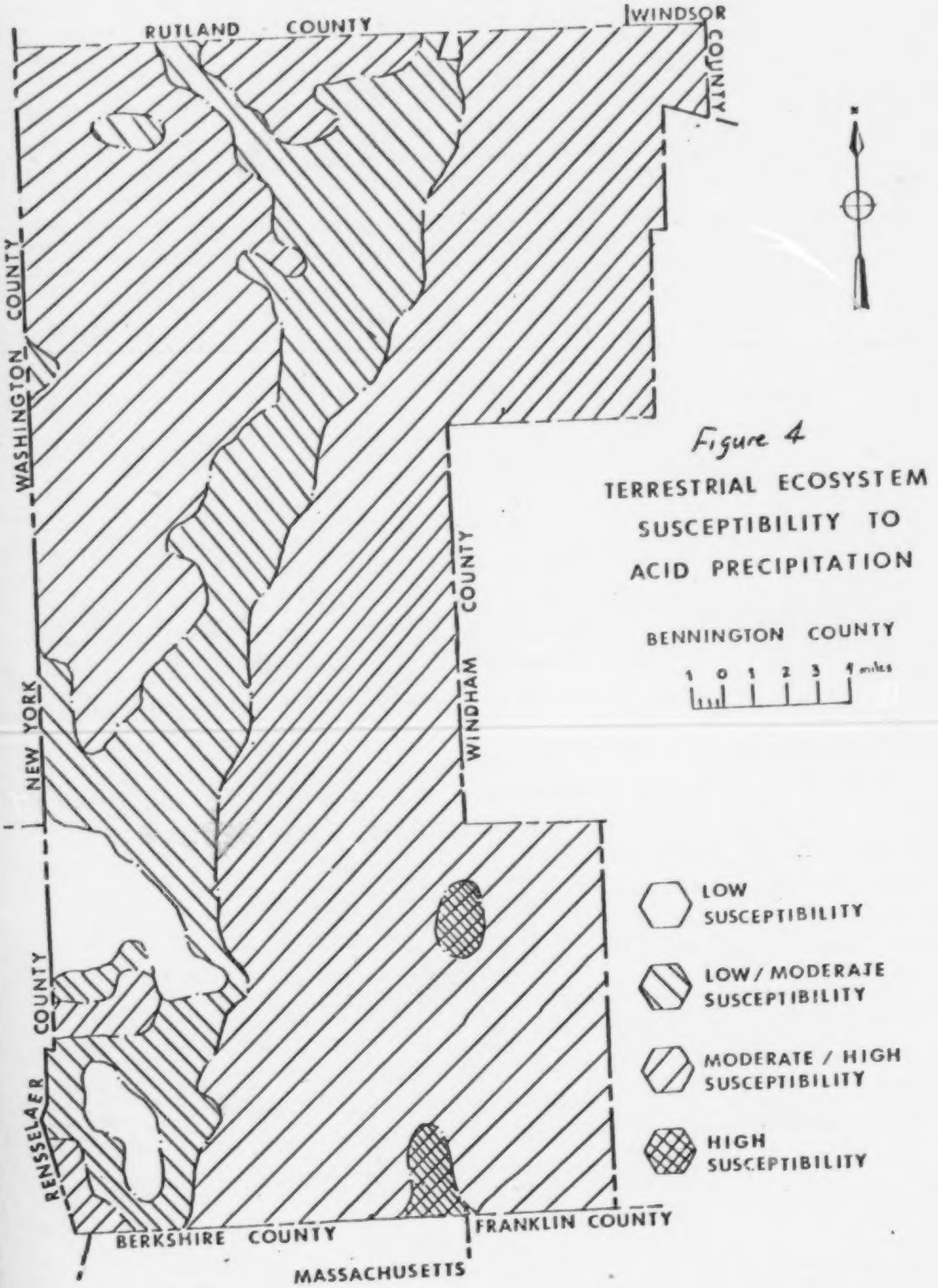
Figure 3

TERRESTRIAL ECOSYSTEM SUSCEPTIBILITY TO ACID PRECIPITATION

FRANKLIN COUNTY

DECEMBER 1980

- from Donnelly & MacGregor (1981)


RUTLAND COUNTY
WINDSOR COUNTY
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WINDHAM COUNTY
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FRANKLIN COUNTY
MASSACHUSETTS
1 0 1 2 3 4 miles
LOW SUSCEPTIBILITY
LOW / MODERATE SUSCEPTIBILITY
MODERATE / HIGH SUSCEPTIBILITY
HIGH SUSCEPTIBILITY

Figure 4

TERRESTRIAL ECOSYSTEM SUSCEPTIBILITY TO ACID PRECIPITATION

BENNINGTON COUNTY

- from Donnelly & MacGregor (1981)

DECEMBER 1980

6. The relative sensitivity of native plant species to acid precipitation is largely unknown. In fact, there is no direct evidence that acid precipitation has altered the species composition and/or growth rate of any terrestrial ecosystem in Vermont.
7. Drainage waters from coniferous foliage is probably more acidic than that from deciduous hardwood foliage because coniferous foliage is less able to neutralize the acidic inputs.
8. Agricultural lands are considered to be less sensitive than are forests because lime applied to cultivated lands tends to neutralize acid inputs.
9. If subsequent studies conclusively demonstrate that acid precipitation is significantly altering physiological responses in Vermont's terrestrial ecosystems, the problem may not be due solely to acids; rather, the problem may be due to the synergistic effects of heavy metals in combination with low pH."

IV

CONCLUDING REMARKS

It is clear to me that insufficient knowledge exists for society - yes and even for congress - to judge the future consequences of acid precipitation/atmospheric deposition on New England or on other parts of our country. We do not know the consequences if, as a country, we chose to do nothing for the next ten or so years nor do we know the consequences if our choice is to, in some fashion, control acid precipitation/atmospheric deposition. We do not know the costs nor benefits of our actions or inactions either in terms of our regional and national economy, in terms of the long term health of our people or of the long term impact on our aquatic and terrestrial ecosystems.

My testimony supports the notion that we have taken but a first step in the long road to address the acid precipitation/atmospheric deposition issue. We now know some of the questions that should be asked - but - we have precious few answers. We are even further away from rationally integrating understanding of this issue into management and regulatory frameworks. Substantial research is needed; it should begin now so that we'll have some answers 3, 5 or 10 years from now.

Thank you, Mr. Chairman and Committee Members for permitting me the time to appear before you.

ACID RAINFALL IN VERMONT

By
David R. Hemenway
Department of Civil Engineering
University of Vermont
Burlington, Vermont 05405

At one time, acid precipitation was thought to be a problem that occurred only in the European countries and that the United States and Canada would not experience similar problems. However, current research and environmental measurements clearly show that the United States is experiencing its own acid precipitation (1,2). While available data indicates that there are regional problems and that a trend has developed, much is not known. The recent proposals to eliminate, reduce or prolong federal requirements of the clean-air act are ignoring the economic and social as well as the environmental impacts of acid precipitation.

Most persons accept the traditional source-transport-receptor model, and as a result, few question the concept of air pollution emissions being carried aloft and subsequently being deposited on the soil and receiving bodies of water. Research carried out in the Department of Civil Engineering Environmental Quality Laboratory has shown that the pH -- a measure of the hydrogen ion concentration -- has reached values as low as 3.35 and that sulfate levels have been as high as 9.8 mg/L in rain water collected at a site in Vermont. The pH was not the level one would predict for clean air in contact with carbon dioxide. A good correlation (r = 0.90) was found between pH and total soluble sulfate in the rain samples. Other laboratories have shown similar data and have begun the documentation effort to show the trend of increasing acid precipitation (lower pH values, higher sulfate values).

Thus, a brief statement of the current problem would be that the State of Vermont is experiencing effects from transport of acid forming airborne contaminants. Unfortunately, there are many questions that remain unanswered.

Acid precipitation or more correctly suppression of precipitation pH by airborne contaminants is poorly understood. The following are a list of a few areas where we have insufficient information and yet, the questions apply directly to the problems created by acid precipitation:

1. What are the true environmental, social and economic costs of acid precipitation? Few studies exist to provide data on the costs of the effects from acid precipitation.
2. What is the relationship between the sources of air contaminants and the effects felt in the State of Vermont? The transport processes with subsequent rainout during transport and the photochemistry involved are poorly understood thus, making the relationship of source to receptor difficult to interpret.
3. What are the potential long-range health effects from dry precipitation transport?
4. What other effects would be expected to co-exist with acid precipitation? It may well be that pH suppression is only the tip of the iceberg with respect to acid precipitation.

Studies are being conducted at the Department of Civil Engineering on the transport of selected heavy metals and their subsequent solubility in the presence of acid precipitation. Other investigators have shown the effects of toxicity of aluminum ions on fish in depressed pH situations (3). It is conceivable that many other toxic compounds would be both transported into the environment as well as released under the low pH conditions present in acid precipitation.

5. What is the recovery time of the environment should the acid precipitation cease or if it were doubled?

The questions of whether or not control technology exits often arise. For the most part, the technology, both in equipment and management, exists. The control technology is extremely expensive, however. Because of the inter-state and inter-nation relationships of the air movement processes, control efforts must be directed on a nationwide as well as a continentwide basis.

Investigative efforts currently promoted by EPA and DOE center on receptor oriented research (effects on water and the ecology of the streams and lakes; effects on soil and vegetation, etc.) and source oriented research (use of scrubbers to remove SO_2 from flue gases; coal liquification to remove sulfur and reduce fly ash, etc.).

It is inconceivable that the United States Government would pick this point in time to roll-back or eliminate the current clean-air legislation. Unfortunately, more legislation is needed at this time and for this problem -- not less.

The answers to the few questions stated above will not be available without research and this will require funding. Control efforts will not be implemented until directives are issued from a central authority and these directives require enabling legislation. No recovery of economic losses from acid precipitation will occur unless the bills or laws exist to allow for this recovery.

With the switch-over from oil to coal, the development of synthetic fuels and the ever increasing usage of energy, environmental protection, not just of lakes and streams, but also of people is mandatory. The effects of acid precipitation will escalate as we dump more contaminants into the air and as we switch to alternative energy sources which inherently produce greater levels of contamination. We may well find that the observed effects of pH suppression are only an indicator of other much more complex and interrelated effects that are poorly understood at this time. The need for an air pollution clean-air act is clear -- not for its elimination.

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2. Johnson, N.M., Science, Vol. 204 (497-499) 1979.
3. Driscoll et.al., "Effect of Aluminum Speciation on Fish in Dilute Acidified Waters" Nature Vol. 284 (161-164) 1980.

TESTIMONY OF JOHN J. EASTON, JR.

ATTORNEY GENERAL

OF VERMONT

TO SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

MR. CHAIRMAN: I am pleased to have the opportunity to appear before your committee to testify on one of the most important pieces of legislation to be considered by the Congress this year.

I appear before you today in two capacities: as Attorney General of the State of Vermont and as Chairman of a newly created subcommittee of the National Association of Attorneys General.

In this second capacity, I am pleased to present a resolution adopted by the National Association of Attorneys General just last Friday, June 26, at its Seventy-Fifth Annual Meeting. The significance of this resolution cannot be overstated since the National Association of Attorneys General represents a cross section of state concerns, political philosophies and regional interests.

As you can see, the Association has taken a strong and forceful position on the very fundamental issues which your committee will be debating. Our association continues to support ambient standards with the highest priority being the public health and safety.

We continue to support the prevention of significant deterioration (PSD) program in order to protect air quality in areas cleaner than the national standards.

The National Association also urges the Congress to address interstate pollution and in particular the problem of acid rain.

We also would suggest that appropriate enforcement remedies be available to both federal and state governments for instances of noncompliance with air quality standards.

While I am able at the present time to provide you with the National Association of Attorneys General position in these broad areas, I am also pleased to inform you that a Clean Air Act Subcommittee which I will head has been appointed to draft a report to the Congress outlining the views of the Association on these issues and our rationale for these positions. I would hope to have to your committee within approximately two months a final report, more thoroughly explaining the National Association's positions.

As Attorney General of Vermont, I am particularly concerned about the issue of interstate pollution and acid rain. Vermont and the other Northeastern states have soils with high sensitivity to acid rain damage. While Vermont is blessed with a buffering capacity which has limited the damage in many areas, we have nevertheless found lakes in two main geographical areas with ph levels below 6.5: 1) the southern third of the Green Mountains, 2) the extreme northeastern part of the state. Lakes in these regions have low alkalinity and, therefore, are much more susceptible to the threat of acid rain. We certainly want to avoid the plight facing our sister state of New York, where almost 200 lakes in the Addirondacks are now without fish.

The need for the Clean Air Act to address the problem of acid rain is particularly demonstrated by Vermont's experience. Vermont emits the smallest amounts of SO_2 of any state in the country, and yet has relatively high annual concentrations of sulphate particles over the state. Sulphate concentrations in a 24-hour period have been recorded as high as 44 micrograms per cubic meter. This level of concentration is as substantial as that found in larger urban areas of our country. Yet, Vermont has done nothing to cause such pollution. As a result, we are particularly sensitive to the need for the Clean Air Act to address this problem.

I suggest for your consideration the following remedies as a way to deal with the problem of long range transport.

1) Appropriate funds to carry out the acid precipitation research program previously authorized.
2) Require significant SO_2 emission reduction over the next ten years.
3) Direct the EPA to set a fine particulate standard for sulphates and nitrates to replace the total suspended particulate (TSP) standards.
4) Prohibit any net increases in emissions from oil-fired plants converting to coal.
5) Impose a measure which would require mandatory coal washing for all utilities burning more than 2% sulphur coal.

As a State Attorney General I am particularly aware of the need for strong and vigorous enforcement of the Clean Air Act. My office performs the legal work for our State Agency of Environmental Conservation and will therefore be in partnership with the agency as it endeavors to meet the challenges of the 1980's. It is important, therefore, that Congress continue to pursue the goal established in 1970 of protecting the public's health and welfare by assuring that air quality standards are obtained and the goal of the Act is realized.

RESOLUTION PASSED AT ANNUAL MEETING
OF
NATIONAL ASSOCIATION OF ATTORNEYS GENERAL

June 24-27, 1981

CLEAN AIR ACT REAUTHORIZATION

WHEREAS, the National Association of Attorneys General is in support of the purposes of the Clean Air Act identified at the time of its enactment by Congress in 1970, especially that air pollution is an interstate problem that endangers public health and welfare, agricultural crops, livestock, and property; and

WHEREAS, the interstate nature of the problem requires an appropriate balance between local, state, and federal government in enforcement of the Act; and

WHEREAS, state Attorneys General, who have the primary responsibility for enforcing the Act at the state level, are in a unique position to provide information about how administration of the Act could be improved from the standpoint of efficiency, equity, and uniformity;

NOW, THEREFORE BE IT RESOLVED, THAT the National Association of Attorneys General:

I.

Supports reauthorization of the Clean Air Act and urges that the Congress:

A. Provide an active role for EPA in enforcement under the Act.

B. Establish deadlines for attaining ambient air quality standards. While recognizing that current deadlines may be impossible to meet in some areas, the Association believes that the Congress, where necessary, should extend rather than eliminate these deadlines.

C. Develop all standards with public health and safety as the highest priority.

D. Designate certain regions in cooperation with the states and state legislatures as PSD areas. The prevention of additional pollution in such areas is clearly in the public interest.

E. Provide enforcement remedies available to federal and state governments for instances of non-compliance with air quality standards. Reliance on voluntary standards without the availability of sanctions would undercut the purpose of the Act.

F. Address the problem of interstate pollutants and "acid rain".

II.

Authorizes the President of the Association to appoint a Clean Air Act Subcommittee to monitor legislative developments in the Congress, to report to the Association on these matters, and to draft, where appropriate, legislative amendments relating to revision of the Clean Air Act giving particular consideration to the unique situation of the territories. The Subcommittee is empowered, in consultation with its Chairman, members, President of NAAG, and Chairman of the Environmental Control Subcommittee, to refine positions already taken by the Association and to adopt new ones where the Chairman, members, and NAAG President determine that a consensus on the issue exists within the Association, and that it is based on complete or near unanimity.

III.

Authorizes the Clean Air Act Subcommittee to draft a Report to the Congress outlining the view of the Association on issues relating to the Clean Air Act reauthorization and the rationales for those positions. The timetable for completion of that Report follows: (the dates are deadlines by which each step will be accomplished)

A.	July 2	Appointment of the Subcommittee Chairman, members, and staff contacts.
B.	July 10	First Subcommittee meeting and drafting of preliminary Report.
C.	July 20	Circulation of proposed draft Report to all Attorneys General and Environmental Division Chiefs.
D.	August 7	Comments on proposed draft Report due in NAAG office.
E.	August 14	Mailing of revised Report to all Attorneys General and Division Chiefs.
F.	Sept. 4	Final approval of Report to NAAG office. The Report will be adopted if there is complete or near unanimity.

BE IT FURTHER RESOLVED, THAT the General Counsel of this Association is authorized to make the views expressed in Part I of this resolution known to the Congress, the Administration, and other appropriate individuals.

CONNECTICUT'S VIEWS ON
THE CLEAN AIR ACT

BEFORE:

THE HONORABLE ROBERT T. STAFFORD,
UNITED STATES SENATOR, CHAIRMAN,
COMMITTEE ON THE ENVIRONMENT AND PUBLIC WORKS

PRESENTED BY:

KENNETH N. TEDFORD,
ASSISTANT ATTORNEY GENERAL
STATE OF CONNECTICUT, DEPARTMENT
OF ENVIRONMENTAL PROTECTION
165 CAPITOL AVENUE
HARTFORD, CONNECTICUT 06115

LEONARD BRUCKMAN, DIRECTOR,
AIR COMPLIANCE UNIT, STATE OF
CONNECTICUT, DEPARTMENT OF
ENVIRONMENTAL PROTECTION
165 CAPITOL AVENUE
HARTFORD, CONNECTICUT 06115

JUNE 30, 1981

Introduction

It would not be an exaggeration to say that the actions of the 97th Congress on the Clean Air Act (the Act) are of critical importance to the environmental and economic well-being of the State of Connecticut and its citizens. The Clean Air Act has significant impact on many different economic, governmental, and population sectors of Connecticut. Some impacts are more subtle, complicated, and obscure than others; but the stakes are high in such important areas as: economic development potential, transportation systems, energy policy, urban and rural balance and governmental cost-effectiveness.

In offering the following comments and recommendations, the State of Connecticut expressly disavows any intent to "gut" the Act, but rather seeks changes to make it work better to achieve the objectives it was originally intended to pursue. Connecticut values clean air and has demonstrated its leadership over the past decade in controlling air pollution effectively. However, Connecticut's commitment has not been shared nationally and we find ourselves at intolerable economic, energy, transportation, and fiscal disadvantages relative to other states. These disadvantages stem from inequities in the law and its administration as well as the accident of location. Connecticut is committed to ensuring that these inequities are addressed by the 97th Congress.

Legal Actions

Connecticut has been forced to file several actions against a sister state, EPA, and utilities as a result of EPA's failure to address interstate air pollution, a crucial federal issue.

Connecticut has petitioned the United States Court of Appeals for the Second Circuit to review a final rule of EPA in approving a special limitation under the New York State Implementation Plan allowing Consolidated Edison of New York ("Con-Ed") to use higher sulfur content fuel oil. EPA, in approving the state implementation plan, failed to require under Section 110(a)(2)(E) of the Act the plan to contain adequate provisions insuring compliance with the requirements of Section 126 of the Clean Air Act relating to interstate pollution abatement and further failed to assess the aggregate impact of sources of sulfur dioxide in New York upon the ambient air quality of Connecticut. This case was argued on February 4, 1981, but a decision has not been rendered.

Connecticut has further petitioned EPA under Section 126 of the Clean Air Act to find that the use of higher sulfur fuel oil in generating facilities of Long Island Lighting Company ("LILCO") and Con-Ed under proposed revisions to the New York State Implementation Plan would have a substantial impact on the air quality in Connecticut. The hearing on such petition was held in December of 1980 and, to date, EPA has not made any decision.

LILCO had a prior special limitation to use higher sulfur fuel which expired on May 31, 1980. LILCO has continued to use such fuel in violation of the federally-approved New York State Implementation Plan although Connecticut gave notice to EPA and New York of such violation requesting that they take immediate action to halt such violations. EPA, New York, and LILCO had not taken any corrective action which then forced Connecticut to institute a citizens suit under Section 304 of the Clean Air Act to enjoin such violations. This action was brought in the United States District Court for the Eastern District of New York, and is awaiting an answer from the defendants to Connecticut's complaint.

Connecticut on June 19, 1981, testified at a public hearing before EPA in support of a New York and Pennsylvania Section 126 petition to abate interstate air pollution from specific sources in the States of Illinois, Ohio, West Virginia, Indiana, and Tennessee.

Context

The federal Clean Air Act establishes, in theory, a federal-state partnership to achieve national air quality goals through programs developed and implemented by each state in accordance with its particular needs and priorities. Unfortunately, both the law and its administration have strayed from this concept considerably. The "partnership" terms are dictated by the "senior partner" -- EPA -- with precious little discretion left to the states. The burden of achieving national air quality goals is falling disproportionately on some regions of the country, particularly the Northeast. States are increasingly asked to respond to important national goals other than air quality, without the flexibility to achieve workable balances among these competing objectives.

EPA has taken an excessively legalistic approach to its role under the Clean Air Act, preferring to attempt to guarantee absolute compliance with all applicable rules and "guidelines" before permission to go forward with any program element is granted. This involves EPA in every aspect of state program administration, including routine day-to-day decision making -- looking over the states' shoulders.

The decentralization of EPA's authority results in the Act being interpreted in different ways, and with different emphases, in each of ten regions. The practical result is that the rules are not the same for different states. The role of geography exacerbates this administrative inequity. Because of the law's reliance on a "clean it where you find it" approach, some states can permit virtually unrestricted emissions and export the resulting air pollution to downwind states which must try to make up for the burden the prevailing winds bring. The situation is so extreme that a recent National Commission on Air Quality study estimated that completely shutting down all Connecticut factories and motor vehicles would still not result in attainment of the ozone standard, so great is the contribution from out-of-state sources. Similarly, a recent enforcement order in another state, which merely required compliance with an existing sulfur emission limit, will reduce atmospheric loadings of sulfur dioxide by more than is emitted by all fuel burners in Connecticut.

As energy costs rise and pressure to use more coal mounts, states are called upon to relax applicable emission requirements to permit the burning of cheaper (dirtier) fuels. High borrowing cost and consumer resistance make it difficult to require costly pollution control equipment. Overlying the whole is the broad-based recognition of the need to revitalize the nation's industrial base and the widely held perception that environmental laws are a barrier to this. It is the states which must cope with these competing objectives, and they must do so without any indulgences from their federal "masters" -- the rather rigid Clean Air Act and its even more rigid implementation by EPA.

Goals for Clean Air Act Reauthorization

While there are numerous detailed policy and technical issues which the Congress will be asked to consider as it deliberates over the reauthorization of the Clean Air Act, two aims should be pursued above all others. Both the existing law and any proposed changes must attempt to be consistent with the following two principles:

1. Air quality laws and regulations should result in equal impacts on each state and should be enforced equally and equitably throughout the nation. Each state should be subject to the same program requirements. Each state should be held responsible for regulating only that portion of its air pollution burden which it generates. Control requirements for similar facilities should be similar nationwide. No state should be asked to make sacrifices that other states do not have to make.

2. EPA should carry out a more appropriate federal role and permit the states maximum discretion as to how they meet the requirements to which they are subject. This means granting overall timely approval of state air quality programs followed by post-audit oversight of state program administration and air quality results. EPA should concern itself with public health/air quality impacts of national energy policy and acid precipitation.

Equitable Laws Administered Equitably

It is not Connecticut's intention to support any general relaxation of air quality standards or any retreat from the public health objectives of the Clean Air Act. Rather, Connecticut believes that the burden of attaining these important national objectives should be shared equitably --

by all states, all regions, all sectors of the economy, and all levels of government. Each of the issues discussed below addresses an aspect of the existing program which is presently inequitable in one or more of these respects.

Each state should be responsible for controlling emissions of in-state sources only, not for compensating for emission carried into the state by prevailing winds. EPA permits use of a "design value" for ozone that excludes at least some out-of-state emissions. No similar approach is permitted for other pollutants, nor is "imported" ozone completely excluded from any state's clean-up agenda. Conversely, states or metropolitan areas which contribute significantly to air pollution elsewhere, but do not record violations themselves, are exempt from many requirements to which the recipients of their emissions are subject.

A source-based approach, as it might be called, would eliminate, or at least alleviate, the most grievous of these inequities. It would, it is recognized, result over the long term in somewhat higher ambient air pollution levels in states downwind of the nation's most developed and industrialized areas than in less developed areas. Such states would have the option of adopting additional air pollution control measures if they wished, but the balancing of air quality and economic objectives would be their responsibility and would be responsive to local values and priorities.

The reconciliation of national energy policy priorities with national environmental policies should be accomplished at the national level. For example, under the present circumstances, a state in which a power plant is ordered to convert to coal has two equally unattractive options. It can require the plant to comply with a similar emission level as with oil, which will impose the high cost of retrofitting on already-burdened utility customers without corresponding savings. Alternatively, the state could permit conversion to coal without stringent emission limits and find itself with no margin for growth in emissions from new or expanded sources which afford greater economic benefits.

If the Congress believes it is in the national interest to burn more domestic coal by requiring fuel switching at existing installations, then the nation should share in the financial and environmental costs of accomplishing this national goal. Uniform requirements should be imposed on coal burning power plants and/or coal washing should be required. The costs of retrofitting existing plants to burn coal in compliance with uniform standards should be shared nationally, and any emissions increase should be exempt from the prevention of significant deterioration limitations.

The prevention of significant deterioration program (PSD) was intended to alleviate geographical inequities, but has had many unintended effects. That the PSD program is in disarray and must be revised significantly is a widely held view. The program's complexity, the imbalance between the effort needed to implement the program and its limited air quality benefits, and numerous incompatibilities with other Clean Air Act provisions are the most prevalent targets for criticism.

Connecticut is in general agreement with these points, but is particularly concerned with two others. The assumption behind PSD is that a clean area is clean because of a general lack of major emission sources, not because it places more stringent controls on major sources than are needed to avoid violations of national standards. When a PSD limit is applied in an instance such as the latter, the state and its industries are penalized for having voluntarily done more for clean air, and they are locked in forever to the high costs of having done so. This effect was probably unintended and is surely inequitable.

Connecticut's other PSD-related concern stems from the Alabama Power v. Costle decision, which held that PSD applies to major new sources and also even to very small modifications to existing major sources. The unintended and rather curious result is a greater burden on the older industrialized areas, where economic growth occurs largely by plant expansion or renovation, than on the regions where new starts are more prevalent. The Congress must address this contradiction when it tackles the PSD program.

The air pollution control requirements on similar sources should be comparable, regardless of location. The investment decisions of industry should not be determined by where they can avoid pollution control expenses. Such an emission-based approach would avoid giving an unfair advantage to states which enjoy cleaner neighbors and cleaner air, or states which have failed to fulfill their regulatory responsibilities under the Act. It would also result in lower aggregate levels of air pollution, since at least a moderate degree of control would be required everywhere.

New source performance standards (NSPS) and national emission standards for hazardous air pollutants (NESHAP) are examples of equitable regulations, but apply to relatively few sources. EPA's control techniques guidelines (CTG) for hydrocarbon sources are also applicable in most areas, at least for those facilities to which they apply. This approach to regulation of major sources should be expanded so as to provide reasonably consistent national emission limits for major sources of air pollution and remove the incentive to seek out locations in states with weak air pollution regulations.

EPA's monitoring requirements should be adminstered equitably, and use of air pollution models should be limited. That a state or area can escape the non-attainment requirements of the Act simply by failing to measure their air pollution is unconscionable. A so-called "unclassifiable" area should be assumed to be non-attainment until shown to be otherwise. This would remove the incentive to avoid measuring the problem, and would protect the health and welfare of those who are exposed to likely but unproven violations.

EPA's excessively legalistic approach to the 1979 SIP revisions has resulted in an inordinate reliance on overly conservative air pollution models. The assumptions used in these models are frequently so conservative as to result in much more stringent emission limits than might actually be required to attain the standards. Modeling extreme conditions is much more speculative than average conditions for which models are more useful. This reliance on hypothetical emissions and theoretical modeling has gone so far that most of the analysis involved in adminstering air pollution programs has almost nothing to do with actual emissions from actual sources.

Relaxation of auto emission standards to provide economic relief to the auto industry shifts the burden of pollution control to local transportation systems. Yet each incremental relaxation of the tailpipe standards is not accompanied by a similar postponement of the attainment deadlines for the air pollutants emitted by cars. It is more cost-effective to reduce automotive pollution at the tailpipe than to reconstruct our urban transportation systems.

Most of the so-called "reasonably available control measures" (RACM) advocated as a means to reduce urban automotive pollution are extremely costly, unpalatably coercive or both. Moreover, they do not appear capable of achieving more than negligible pollution reductions, and some argue that they may conceivably result in increased pollution by encouraging sprawl. If EPA and the Congress believe that major transportation investments should be made on the basis of air pollution reduction objectives rather than mobility needs, transportation funding should be apportioned accordingly.

Attainment and other deadlines under the Act should be set in such a manner as to require a comparable level of effort by each state, even if this results in some geographical variation in when standards are actually attained. In other words, states which have already taken the "easy" steps toward air pollution reduction should not be required to undertake draconian measures when other states are only just beginning to take the Clean Air Act seriously. These latter states can show impressive percent reductions much more readily and with much less sacrifice. Too often, the Act is administered in such a way that the question isn't, "How much have you done for air quality?" but rather "What have you done lately?" Expanding the use of nationally applicable emission standards is one part of resolving this inequity; establishing deadlines more realistically is another.

Conclusion: All of the issues discussed above are aimed at reducing the disparities among regions with respect to the burden imposed by the Clean Air Act. This burden is heaviest on the Northeast because of its location downwind of major sources, its closely spaced urban areas, its heavy dependence on oil (as opposed to cleaner natural gas), and its early commitment to air pollution control.

The burden of other national policy priorities which require substantial public and private investment also falls most heavily on the Northeast -- national energy policy which requires conversion from oil to coal and the hazardous waste management program, among others. These national policy burdens come at a time when the Northeast is also disproportionately burdened by the increase in world oil prices; when industrial modernization investment is concentrated elsewhere and older Northeastern plants are phased out; and when state and local fiscal capabilities are particularly stressed. Perhaps the Northeast would not be viewed by the rest of the nation as having its hand out if it were not for the disproportionate share of the burden it bears for achieving national energy, environmental, and economic policy goals.

Appropriate Federal and State Roles

The Clean Air Act program is frequently said to be a federal-state partnership, but it is more often the federal "partner" which makes this claim. While the concept embodied in the 1970 Clean Air Act -- individual state plans, with consistency, coordination, and compliance assured at the federal level -- is sound, it has been modified considerably over the last decade, both by amendments to the Act and by the administrative style of the EPA.

In part, the strengthening of the federal role was appropriate. Many states did not fulfill their responsibilities under the Act, because they lacked either the capacity or the will to do so. Moreover, air polluton turned out to be a more complex problem than had originally been thought. As a result, the 1977 amendments to the Act went into much greater detail as to what is required of the states, leaving fewer of the choices in their hands, and conferred greater authorities on the EPA.

Concurrent with this trend to place much more responsibility at the federal level was the delegation of EPA's authority to the regional level. Thus, not only was EPA taking on more of the responsibility for the program, but it was doing so in ten different ways. Despite EPA's efforts to assure consistency among regions in broad policy areas and on certain technical issues, it is the day to day adminstration, priority-setting and decision-making which cumulatively determine the kind of EPA to which the states must respond. Examples of significant inconsistencies among regions are numerous and widely cited.

A careful reconsideration and "sorting out" of the appropriate roles for federal and state government is required at this time, because the present relationship is at an impasse. Meeting all of EPA's demands is impossible in many instances, and the sanctions EPA can impose are so punitive as to be impractical. Further, while EPA insists on reserving the authority to review and approve virtually every state program action, it cannot keep up with the workload.

Not only must the division of labor be revised, but the tone of the EPA-state relationship needs to be changed as well. Too often now EPA assumes the role of a stern parent with a recalcitrant child, even when the "child" has been anything but. In addition to learning to deal with the states as responsible partners, EPA must find a way of more effectively ensuring consistency in its dealings with different states. Whether this is accomplished by recentralizing agency authority in Washington or by some other means is not critical; that it be accomplished is.

The following is Connecticut's view on an appropriate division of responsibilities between EPA and the states.

EPA should:

- Establish national ambient air quality standards.

* Develop, promulgate, and update uniform national emission limitations for major sources.

* Provide timely, consistent guidance and interpretation of the Act's provisions.

* Develop, with substantive input from the states, regional strategies for addressing pollution problems at a scale appropriate to each pollution problem.

* Resolve interstate pollution issues.

* Provide financial support for administration of states' air pollution programs. Such support should be commensurate with the requirements applicable to state programs.

* Review and approve the overall structure and content of state programs, providing they are generally in conformance with the Act's requirements.

* Monitor and evaluate state program performance based on air pollution results and program post-audit.

* Promulgate federal plans or initiate federal enforcement actions only where states fail to act and this failure threatens public health or interstate equity.

- Work with other federal agencies to coordinate federal air quality policy with other federal policies such as energy, transportation, economic revitalization, and other environmental programs.

- Undertake and support research and technology development activities consistent with the goals of the Act.

States should:

- Develop air pollution control strategies for in-state sources which will attain and maintain ambient air quality standards, disregarding transported pollutants in excess of levels permitted in the regional or national plan. Plans would be made up of strategies shown to be most cost-effective or otherwise desirable from the State's particular perspective.

- Operate an air pollution control program consistent with the plan, including monitoring, source permitting, inspection, and maintenance.

- Coordinate the air pollution control program with other important policies and programs at the state level.

* Provide evidence to EPA of substantial compliance with the Act, with an emphasis on air quality results.

It should be noted that the states' tasks, as described above, are by far the more difficult. It is still the states which must attempt to strike the proper balance among competing energy, economic, fiscal, and environmental objectives which is the most difficult (administratively and politically) aspect of dealing with air pollution. EPA's role is to create an equitable national and regional framework within which this can take place.

TESTIMONY BEFORE THE SENATE ENVIRONMENT AND PUBLIC WORKS COMMITTEE

BY RICHARD HLUCHAN
DEPUTY ATTORNEY GENERAL

NEW JERSEY DEPARTMENT OF LAW AND PUBLIC SAFETY

GOOD MORNING. MR. CHAIRMAN AND MEMBERS OF THE SENATE COMMITTEE ON THE ENVIRONMENT AND PUBLIC WORKS. MY NAME IS RICHARD HLUCHAN, I AM A DEPUTY ATTORNEY GENERAL FOR THE STATE OF NEW JERSEY. I HAVE REPRESENTED THE STATE IN LITIGATION CONCERNING VARIOUS ASPECTS OF ENVIRONMENTAL LAW. IN PARTICULAR, THE STATE HAS BEEN INVOLVED IN SEVERAL MATTERS CONCERNING THE CLEAN AIR ACT AND TRANS-BOUNDARY AIR POLLUTION PROBLEMS.

THE STATE OF NEW JERSEY WELCOMES THIS OPPORTUNITY TO PRESENT ITS VIEWS ON THE PROBLEMS OF INTERSTATE AIR POLLUTION. IT IS OUR POSITION THAT, AS CONTEMPLATED BY THE ACT, THE U.S. ENVIRONMENTAL PROTECTION AGENCY APPROPRIATELY HAS THE PRIMARY RESPONSIBILITY TO MEDIATE AND DETERMINE INTERSTATE AIR POLLUTION DISPUTES. SECTION 126 OF THE ACT, WHICH WAS ENACTED AS PART OF THE 1977 AMENDMENTS, PROVIDES AN APPROPRIATE FRAMEWORK WITHIN WHICH TO ADDRESS SUCH PROBLEMS. IN OUR EXPERIENCE, HOWEVER, SECTION 126 SUFFERS FROM A NUMBER OF DEFICIENCIES WHICH HAVE HINDERED EPA IN FULFILLING ITS ROLE. AMONG THESE DEFICIENCIES ARE:

1. THE TIME PERIODS FOR DISPOSITION OF A SECTION 126 PEITION ARE UNREALISTIC AND THE PROCEDURES FOR CONSIDERING SUCH A PETITION ARE UNCLEAR;

2. THE STATUTE IS NOT BROAD ENOUGH IN COVERAGE SINCE

IT ONLY INCLUDES POLLUTANTS FOR WHICH NATIONAL STANDARDS HAVE BEEN ADOPTED, THEREBY ELIMINATING SUCH PHENOMENA AS ACID DEPOSITION WHICH IS OF PARTICULAR CONCERN TO NEW JERSEY; AND

3. THE STATUTE DOES NOT PROVIDE ADEQUATE GUIDANCE AS TO WHAT EPA CAN DO SUBSTANTIVELY TO RESOLVE A PROBLEM WHEN IT IS IDENTIFIED. FOR EXAMPLE, THE STATUTE IS SILENT AS TO HOW MUCH INTERFERENCE WITH A STATE'S PREVENTION OF SIGNIFICANT DETERIORATION (PSD) PROGRAM WILL BE TOLERATED.

SINCE THE FLOW OF AIR FOLLOWS THE LAWS OF NATURE WITHOUT REGARD TO MANMADE JURISDICTIONAL BOUNDARIES, EMISSIONS OF POLLUTANTS IN ONE STATE CAN AND DO HAVE ADVERSE EFFECTS ON AIR QUALITY IN OTHER DOWNWIND STATES. THE EXTENT OF THE PROBLEM GENERALLY VARIES WITH THE LENGTH OF TIME POLLUTANTS ARE IN THE AIR AND THE EXTENT TO WHICH POLLUTANTS REACT TO FORM NEW OR SECONDARY POLLUTANTS.

I WILL BRIEFLY DISCUSS SEVERAL POLLUTANTS WHICH BY VIRTUE OF THEIR ABILITY TO BE TRANSPORTED CONTRIBUTE TO TRANSBOUNDARY AIR POLLUTION PROBLEMS.

CARBON MONOXIDE, FOR EXAMPLE, CREATES LOCALIZED PROBLEMS. HIGH CONCENTRATIONS EXIST USUALLY ONLY WITHIN A FEW HUNDRED YARDS OF CONGESTED AUTOMOBILE TRAFFIC, AUTOMOBILE EXHAUST BEING THE PREDOMINANT SOURCE OF CARBON MONOXIDE. INTERSTATE PROBLEMS FOR THIS POLLUTANT ARE UNLIKELY TO ARISE EXCEPT POSSIBLY IN AN URBAN LOCATION DIRECTLY ON AN INTERSTATE BOUNDARY.

ON THE OTHER HAND, SOURCES OF PARTICULATES OR SULFUR DIOXIDE CAN UNQUESTIONABLY PRODUCE SIGNIFICANT CONCENTRATIONS OF THOSE POLLUTANTS OVER DISTANCES OF SEVERAL MILES. LARGE POWER PLANTS AND INDUSTRIAL FACILITIES WITHIN A FEW MILES OF AN INTERSTATE BOUNDARY CAN HAVE AN ADVERSE EFFECT ON AIR QUALITY IN AN ADJACENT STATE. THE SAME IS TRUE FOR THE PRECURSORS OF OZONE IN LARGE URBAN AREAS EXTENDING ACROSS AN INTERSTATE BOUNDARY.

FURTHERMORE, HIGH OZONE CONCENTRATIONS APPEAR OVER DISTANCES OF HUNDREDS OF MILES FROM THE SOURCE OF ITS PRECURSORS. SIMILARLY, BOTH SULFUR DIOXIDE AND NITROGEN DIOXIDE ARE OXIDIZED IN THE ATMOSPHERE TO SULFATES AND NITRATES AS THEY ARE TRANSPORTED LONG DISTANCES. THESE POLLUTANTS CONTRIBUTE TO PARTICULATE CONCENTRATIONS, REDUCED VISIBILITY, AND ACID DEPOSITION HUNDREDS OF MILES AWAY FROM THE SOURCES. PLEASE CONSULT THE TABLE ATTACHED TO MY TEXT FOR ADDITIONAL INFORMATION. THIS TABLE SHOWS, FOR EACH POLLUTANT, THE PERCENT CONTRIBUTION FROM INDIVIDUAL OR "POINT" SOURCES (SUCH AS INDUSTRIAL PLANTS WITH LARGE EMISSIONS), FROM STATIONARY AREAWIDE SOURCES, AND FROM MOBILE SOURCES (MOSTLY MOTOR VEHICLES). AS YOU SEE, CARBON MONOXIDE IS PRODUCED BY MOBILE SOURCES, AND CAUSES HIGHLY LOCALIZED EFFECTS. AT THE OTHER EXTREME, SULFUR DIOXIDE COMES PREDOMINANTLY FROM POINT

SOURCES, GENERALLY WITH TALL STACKS. ALTHOUGH ITS NEARBY EFFECTS CAN BE DEALT WITH DIRECTLY ITS LONG RANGE EFFECTS ARE NOT AS WELL UNDERSTOOD AND MORE DIFFICULT TO CONTROL.

NEW JERSEY'S EXPERIENCE

THE CITIZENS' SUIT PROVISION IN SECTION 304 HAS PROVEN A USEFUL MECHANISM FOR NEW JERSEY. WE HAVE SUCCESSFULLY USED THE NOTICE OF INTENTION TO SUE AS A CATALYST FOR FURTHER ACTION AND NEGOTIATION IN INTERSTATE POLLUTION MATTERS.

FAIRLESS STEEL WORKS

BORDENTOWN, A NEW JERSEY CITY SEVERAL MILES DOWNWIND OF A LARGE STEEL PLANT, WAS PLAGUED BY RED DUST AND PARTICULATES ON DAYS WHEN THE WINDS CAME FROM THE DIRECTION OF THE PLANT. THE PROBLEM WAS COMPOUNDED BY THE FACT THAT THE PLANT WAS IN PENNSYLVANIA AND NOT SUBJECT TO NEW JERSEY ENFORCEMENT AUTHORITY.

Because the Section 126 petition procedure was deemed inadequate to effectively solve this problem, New Jersey instead filed a Notice of Intent to Sue EPA and U.S. Steel, the plant owner, unless steps were taken to ensure compliance with the Pennsylvania SIP. One month later, in October 1979, EPA and the Justice Department sued US Steel in federal court. New Jersey, Pennsylvania and the City of Bordentown joined as plaintiffs. After a series of negotiations a consent decree was issued in federal district court in Philadelphia. The decree sets forth a detailed schedule for achieving compliance with the Pennsylvania SIP. We chose to seek direct recourse in the judicial process, rather than risk the uncertainties of a Section 126 hearing which would delay resolution of the problem.

PHILADELPHIA SULFUR PLAN

In the early 1970's, Pennsylvania's sulfur-in-fuel limits were such that the city of Philadelphia was not achieving the primary or health related air quality standard for SO_2. This had two adverse effects on New Jersey:

1. First, with over half of the sulfur dioxide concentrations in downwind Camden, New Jersey, coming from sources in Pennsylvania, we had to impose stringent limits on sulfur-in-fuel in order to attain the primary standard in New Jersey. New Jersey limits were, in fact, at least twice as stringent as the limits for Philadelphia and its Pennsylvania suburbs.

2. SECOND, SINCE LOWER SULFUR OIL IS MORE EXPENSIVE NEW JERSEY CONSUMERS WERE FORCED TO PAY MORE TO HEAT THEIR HOMES AND OPERATE THEIR FACTORIES.

FACED WITH THIS SITUATION, NEW JERSEY ONCE AGAIN RESORTED TO SECTION 304 AND THREATENED TO SUE EPA AND PENNSYLVANIA FOR THEIR FAILURE TO ENFORCE PENNSYLVANIA'S SIP. AS A RESULT, THE PARTIES SAT DOWN AND AGREED UPON A REGIONAL STRATEGY AND NO LAWSUIT WAS EVER FILED. THE SCHEME, AS DEVISED IN 1979, PROVIDES FOR AN INNER ZONE WITH LOWER SULFUR-IN-FUEL LIMITS FOR THE DENSELY POPULATED PORTIONS OF THE PHILADELPHIA AND CAMDEN, NEW JERSEY AREA AND AN OUTER ZONE WITH HIGHER SULFUR LIMITS. RESULTANT INCREASES IN EMISSIONS OF SULFUR DIOXIDE ALLOWED IN NEW JERSEY WERE OFFSET BY DECREASES IN SULFUR DIOXIDE EMISSIONS FROM A TIGHTENING OF STANDARDS IN NEIGHBORING PORTIONS OF PENNSYLVANIA.

CON EDISON

SPURRED ON BY ESCALATING ENERGY COSTS AND GOVERNMENTAL POLICIES, UTILITIES HAVE RECENTLY PROPOSED TO CONVERT MANY POWER PLANTS TO COAL USE. THIS HAS SPECIAL SIGNIFICANCE IN THE NEW YORK-NEW JERSEY-CONNECTICUT METROPOLITAN AREA, WHERE A LARGE NUMBER OF THESE CONVERSION CANDIDATES ARE LOCATED. SINCE GROWTH IN THIS VITAL ECONOMIC CORRIDOR MAY BE CONSTRAINED BY THE FINITE PREVENTION OF SIGNIFICANT DETERIORATION INCREMENT, AND SINCE MANHATTAN IS BARELY IN ATTAINMENT OF THE SULFUR DIOXIDE AMBIENT STANDARD, IT IS UNLIKELY THAT ALL PROPOSED CANDIDATES WILL CONVERT TO COAL WITHOUT THE USE OF CONTROL TECHNOLOGY TO REDUCE EMISSIONS OF SULFUR DIOXIDE.

Competition for cheap energy has led to a situation where states now act as advocates for utilities in their states. Each state jockeys for position in the race to claim available PSD margin-for-growth increments.

For example, in November, 1979, in anticipation of a possible conversion to coal, New York State sought EPA approval, as a SIP revision, of a "special limitation" designed to allow the Consolidated Edison Company, Inc. to burn fuel oil with five times more sulfur than previously permitted, for a period of one year. Con Ed claimed that during the "test burn", the use of this higher sulfur oil would simulate emissions from coal. New Jersey was deeply concerned over the effect that such increased emissions would have on the air quality in its industrial and densely populated areas only a matter of miles to the west.

As a result, on April 29, 1980, New Jersey filed with EPA its first petition under the Interstate Pollution Abatement provision, Sec. 126, of the Clean Air Act. The State of Connecticut filed a similar petition weeks later. New Jersey's petition sought a finding that the Con Ed facilities would emit air pollutants, that is, sulfur dioxide and particulates in violation of Section 110(a)(2)(E)(i) if the New York proposal to increase the allowable sulfur content of fuel oil were approved. Also, New Jersey's petition sought an evaluation of the sulfate and acid deposition impacts of Con Ed's proposal.

EPA approved the New York SIP revision, however, in August 1980 without responding to the Section 126 petitions or conducting the required hearing. EPA did conduct a post hoc hearing on issues raised by the petitions in December 1980, but concentrated on broad and wide-ranging regional issues rather than the specific Con Ed facilities. To date, EPA has not issued a final decision on the petition, or published any findings. Meanwhile, Con Ed has been permitted to burn higher sulfur oil pursuant to the August 1980 approval.

This case highlights all the deficiencies of Section 126 already mentioned. New Jersey and Connecticut have challenged EPA's failure to conduct a hearing prior to issuing a final SIP decision. We are awaiting the decision of the Second Circuit Court of Appeals in this case. The issues presented are EPA's duty to adhere to the 60 day time limits of Section 126, and EPA's duty to consider sulfate and acid deposition impacts under Section 126.

A further problem is that the Clean Air Act does not provide sufficient guidance to EPA to enable it to make a determination on interstate air pollution abatement. The Act outlines several considerations to be taken into account in EPA's State Implementation Plan review: The Act provides that one state's SIP may not be approved if,

> -IT PREVENTS ATTAINMENT OR MAINTENANCE OF AMBIENT STANDARDS IN ANOTHER STATE; OR
>
> -IT INTERFERES WITH MEASURES OF ANOTHER STATE TO PREVENT SIGNIFICANT DETERIORATION OF AIR QUALITY OR TO PROTECT VISIBILITY. (SECTION 110(A)(2)(E))

As illustrated by the Con Ed matter, however, the statute gives no guidance as to how much interference with a PSD program will be tolerated. Also, although the legislative history is to the contrary, the Act appears to be limited to consideration in the interstate context of only adopted national standards, to the exclusion of sulfate and acid deposition. These shortcomings must be remedied to provide for effective interstate pollution abatement.

While it may, as in the case of US Steel, be possible to arrive at technical solutions to short range transboundary air pollution, problems multiply many fold when we look at the issue of transport of pollutants over distances of hundreds of miles or more. Ozone provides the most obvious case in point.

It is clear that under commonly occurring weather conditions on the East Coast, the succession of peaks in ozone concentration downwind of metropolitan areas from Washington, D.C. to Boston shows that a mass of precursors and ozone is carried by the prevailing wind from one metropolitan area to the next along the northeastern coast. Moreover, there is evidence of high levels of ozone and of haze over large parts of the country associated with the movements of air masses across the country, and of acid rain from sulfate and nitrate transport. Some of the evidence in regard to ozone was submitted by New Jersey last year in support of its position that substantial parts of the eastern United States were designated improperly as attainment or unclassifiable, rather than non-attainment, for ozone. EPA has yet to respond to

THAT SUBMITTAL, ALTHOUGH AS A RESULT OF A LAWSUIT BROUGHT BY NEW JERSEY, IT IS UNDER COURT ORDER TO REDRAFT ITS OZONE DESIGNATIONS.

SINCE THE GENERAL MOVEMENT OF AIR MASSES ACROSS THE COUNTRY BRINGS THE PRODUCTS OF EMISSIONS FROM SOURCES IN THE MIDWEST TO THE NORTHEAST, NEW JERSEY SHARES THE CONCERN OF OTHER NORTHEASTERN STATES IN REGARD TO SULFATES AND NITRATES AND THEIR CONTRIBUTION TO INHALABLE PARTICULATES, REDUCTION IN VISIBILITY AND ACID DEPOSITION. NEW JERSEY HAS ATTEMPTED TO RESOLVE SOME OF THE INTERSTATE AIR POLLUTION PROBLEMS BY TAKING ADVANTAGE OF OPPORTUNITIES TO COMMENT ON SIPs FOR OTHER STATES AND, WHERE WARRANTED, BY SEEKING RELIEF IN THE COURTS. ALTHOUGH A COURT MAY FASHION RELIEF IN DISPUTES AMONG SEVERAL STATES, IT HAS NEITHER THE EXPERTISE NOR THE AUTHORITY TO DEVELOP COMPLEX STRATEGIES TO RESOLVE TRANSBOUNDARY AIR POLLUTION TRANSPORT ISSUES. ONLY BY A COMPREHENSIVE PLAN OUTLINED BY THE CONGRESS WILL STATES BE ABLE TO ASSUME THE RESPONSIBILITY OF CONTROLLING THEIR OWN POLLUTION.

BEFORE I CONCLUDE, I WOULD LIKE TO OFFER SOME COMMENTS ON ONE PARTICULAR PROBLEM CAUSED BY THE LONG RANGE TRANSPORT OF AIR POLLUTION THAT IS OF SPECIAL CONCERN TO NEW JERSEY AND OUR SISTER STATES IN THE NORTHEAST. THE PROBLEM IS ACTUALLY A WHOLE RANGE OF PROBLEMS DUE TO THE PHENOMENON OF ATMOSPHERIC ACID DEPOSITION.

MUCH OF THE DEBATE ON ACID DEPOSITION TO DATE HAS FOCUSED ON THE QUESTION OF WHETHER WE SHOULD RISK THE INVESTMENT OF CAPITAL TO REDUCE THE PRECURSORS OF ACID RAIN WHEN WE DON'T KNOW PRECISELY

HOW MUCH REDUCTION IS NECESSARY TO SOLVE THE PROBLEM. LOOKING AT THE PROBLEM FROM THE OTHER STANDPOINT, NEW JERSEY BELIEVES THAT THERE IS SUFFICIENT EVIDENCE TO DEMONSTRATE THAT BY ALLOWING ACID DEPOSITION TO CONTINUE UNCHECKED, WE ARE POSING A SEVERE RISK OF DAMAGE TO THE ENVIRONMENT. THE CONCEPT OF RISK, OF COURSE, EMBODIES UNCERTAINTY. NEW JERSEY SUBMITS, HOWEVER, THAT THE PROPER FOCUS FOR THE DEBATE IS TO ACKNOWLEDGE THIS UNCERTAINTY AND CONSIDER WHAT REASONABLE MEASURES MAY BE TAKEN WHICH MINIMIZE THE RISKS ON BOTH SIDES OF THE ISSUE.

LET ME REVIEW QUICKLY WHAT I THINK WE CAN ALL AGREE THAT WE DO KNOW ABOUT THE ACID RAIN PHENOMENON:

- WE DO KNOW THAT ELEVATED LEVELS OF ACIDITY IN OUR LAKES AND STREAMS IS CAUSING SEVERE DAMAGE TO CERTAIN AQUATIC ECOSYSTEMS.

- WE KNOW THAT DEPOSITION FROM THE ATMOSPHERE CAN CONTRIBUTE SIGNIFICANTLY TO THE ACIDITY OF CERTAIN LAKES AND STREAMS.

- WE KNOW THAT EMISSIONS OF SULFUR AND NITROGEN OXIDES CAN CONTRIBUTE SIGNIFICANTLY TO ATMOSPHERIC ACIDITY OFTEN MANY HUNDREDS OF KILOMETERS FROM THE ORIGINAL SOURCE OF SUCH EMISSIONS.

- WE KNOW THAT THE CONCENTRATION OF SULFURIC ACIDS IS SIGNIFICANTLY GREATER THAN CONCENTRATION OF NITRIC ACIDS IN PRECIPITATION WITHIN THE EASTERN UNITED STATES.

NEW JERSEY BELIEVES THAT WHAT WE KNOW NOW ABOUT THE RISK OF IRREVERSIBLE DAMAGE TO OUR AQUATIC ECOSYSTEM, AND THE MOST LIKELY CAUSES OF THAT ACTION, COMPELS US TO TAKE IMMEDIATE BUT REASONABLE STEPS TO MITIGATE THESE EFFECTS.

I HAVE ATTACHED WITH MY TESTIMONY COPIES OF THREE CHARTS WHICH I THINK WILL HELP US TO FOCUS ON THE PARAMETERS OF A FIRST STEP MITIGATION STRATEGY. CHART #1 SHOWS THE TOTAL EMISSIONS OF SULFUR DIOXIDE GENERATED FROM OIL AND COAL FIRED POWER PLANTS FOR EACH STATE EAST OF THE MISSISSIPPI, CHART #2 SHOWS OIL AND COAL FIRED UTILITY EMISSION RATES PER UNIT OF ENERGY GENERATED, AND CHART #3 SHOWS SULFUR DIOXIDE EMISSIONS PER CAPITA FOR EACH STATE. TAKEN TOGETHER WE BELIEVE THESE CHARTS POINT US IN THE DIRECTION OF A REASONABLE AND EQUITABLE STRATEGY FOR ADDRESSING THE ACID RAIN PROBLEM.

CHART #1 SHOWS THE MAGNITUDE OF ATMOSPHERIC SULFUR LOADING AS IT IS DISTRIBUTED ACROSS STATE JURISDICTIONAL BOUNDARIES. EVEN IF WE IN NEW JERSEY TRIED TO TAKE ADDITIONAL ACTION TO REDUCE SULFUR EMISSIONS, IT WOULD HAVE AN INSIGNIFICANT IMPACT ON REGIONAL ATMOSPHERIC LOADING. THE SAME IS TRUE FOR 1/2 TO 2/3 OF ALL THE STATES EAST OF THE MISSISSIPPI. CHART #1 CLEARLY INDICATES THAT ANY MEANINGFUL REDUCTIONS WILL NECESSITATE A REGIONWIDE STRATEGY DIRECTED AT THE NATIONAL LEVEL.

CHART #2 IS A REPRESENTATION OF THE RELATIVE COST OF ACHIEVING ADDITIONAL EMISSION REDUCTIONS. THE ASSUMPTION USED HERE IS THAT

ENERGY GENERATED USING FUELS WITH A HIGHER SULFUR CONTENT IS CHEAPER TO GENERATE AND RESULTS IN LOWER COSTS TO THE CONSUMER. THIS CHART SEEMS TO BE TELLING US THAT THE LARGEST AND CHEAPEST REGIONAL EMISSION REDUCTIONS ARE AVAILABLE IN THOSE STATES BORDERING THE OHIO RIVER VALLEY REGION.

FINALLY, CHART #3 SHOWS SULFUR DIOXIDE EMISSIONS PER CAPITA. JUST AS THE PREVIOUS CHART IS A SURROGATE FOR THE MARGINAL COST OF ACHIEVING ADDITIONAL EMISSION REDUCTIONS, THIS CHART REPRESENTS THE COST BURDEN INDIVIDUAL CITIZENS ARE ALREADY CARRYING FOR POLLUTION ABATEMENT. THE ASSUMPTION HERE IS THAT THESE NUMBERS ARE INVERSELY PROPORTIONAL TO COST FOR POLLUTION ABATEMENT. THUS, HIGHER LEVELS OF EMISSIONS PER CAPITA REPRESENT A LOWER COST BURDEN. THIS MEASURE REFLECTS THE EQUITY ISSUE AND INDICATES AGAIN THAT A FIRST CUT EMISSION REDUCTION STRATEGY SHOULD, AS A MATTER OF EQUITY, CONCENTRATE ON EMISSION SOURCES IN AND AROUND THE OHIO RIVER VALLEY REGION.

BASED ON THESE OBSERVATIONS, I SUBMIT THAT WE CAN BEGIN TO DEFINE THE PARAMETERS OF A REASONABLE, COST-EFFECTIVE APPROACH TO MITIGATING THE ACID RAIN PROBLEM. WHEN DEFINING A COST-EFFECTIVE STRATEGY, HOWEVER, WE MUST ENSURE THAT WE TAKE INTO ACCOUNT THE IMPACT ON COAL MINING JOBS AND THE ECONOMICS OF THE MIDWESTERN COAL PRODUCING STATES. WITH THESE CONSIDERATIONS IN MIND, I PROPOSE THAT A MITIGATION STRATEGY COULD BE DESIGNED AS FOLLOWS:

THE STRATEGY SHOULD FOCUS ON ACHIEVING A 15 TO 20 PERCENT REDUCTION IN SULFUR OXIDE EMISSIONS ORIGINATING THROUGHOUT THE ENTIRE REGION EAST OF THE MISSISSIPPI.

- THE STRATEGY SHOULD ALLOCATE SPECIFIC EMISSION REDUCTIONS ON A STATE-BY-STATE BASIS.
- THE EMISSION REDUCTION TARGET SHOULD BE ESTABLISHED BY IDENTIFYING THOSE STATES WHICH EXCEED A SPECIFIED EMISSION RATE PER CAPITA (BASED ON FOSSIL FUEL FIRED UTILITY EMISSIONS).
- THOSE STATES ABOVE THE EMISSION RATE PER CAPITA CUT-POINT SHOULD BE REQUIRED TO ACHIEVE A SPECIFIED PERCENTAGE REDUCTION IN TOTAL STATEWIDE EMISSIONS.
- ALLOW EACH STATE TO DEVISE ITS OWN STRATEGY FOR ACHIEVING THE ASSIGNED EMISSION REDUCTION TARGET.
- REQUIRE THAT ALL EMISSION REDUCTIONS BE ACHIEVED THROUGH THE APPLICATION OF AIR POLLUTION CONTROL TECHNOLOGY, E.G., COAL CLEANING OR FLUE GAS DESULFURIZATION.

I DON'T SUGGEST, OF COURSE, THAT THIS IS THE ONLY APPROACH, BUT IT IS ONE OF MANY POSSIBLE STRATEGIES THAT COULD BE DEVISED TO ACHIEVE REASONABLE, EQUITABLE, AND COST-EFFECTIVE REDUCTIONS OF REGIONWIDE EMISSION LOADING. THESE STRATEGIES MUST BE DESIGNED, ARTICULATED, AND ANALYZED SO THAT THE DEBATE CAN PROCEED NOW TO BALANCE THE CONSEQUENCES OF MITIGATION MEASURES AGAINST THE RISKS

OF DAMAGE TO THE ENVIRONMENT.

IN RESPONSE TO THE APPROACH I HAVE SET FORTH, YOU WILL HEAR THE ARGUMENT THAT WE SHOULD DO OUR RESEARCH NOW AND THEN SOLVE THE PROBLEM LATER. THOSE WHO MIGHT BEAR THE COST OF A MITIGATION STRATEGY WILL ARGUE THAT WITHOUT MORE PRECISE KNOWLEDGE ABOUT THE CAUSE AND EFFECT RELATIONSHIPS, WE ARE RISKING THE INVESTMENT OF CAPITAL WITHOUT THE ASSURANCE OF COMMENSURATE BENEFITS. NEW JERSEY BELIEVES THAT EVEN IN THE WORST OF CIRCUMSTANCES, WE WILL BE RISKING THE INVESTMENT OF A FEW MILLION DOLLARS. BUT THE REWARDS OF SUCCESS ARE GREAT--HEALTHY LAKES, REDUCED VISIBILITY IMPAIRMENT, AND REDUCED RISK OF TOXIC CONTAMINATION OF OUR DRINKING WATER SUPPLIES. THOSE WHO ARGUE AGAINST THIS APPROACH ARE SAYING IN ESSENCE THAT WE SHOULD EXPERIMENT WITH OUR LUNGS AND LAKES RATHER THAN RISK ANY EXCESS COST TO INDUSTRY. I SUBMIT THEN THAT THE QUESTION THESE DEBATES MUST ANSWER IS: WHICH GAMBLE ARE WE WILLING TO TAKE?

NEW JERSEY WILL CONTINUE TO PAY SPECIAL ATTENTION TO THE PROGRESS OF THE COMMITTEE'S INVESTIGATIONS OF LONG RANGE TRANSPORT AND OTHER COMPLEX AIR QUALITY ISSUES ASSOCIATED WITH INTERSTATE AIR POLLUTION. IF YOU HAVE ANY NEED FOR ADDITIONAL INFORMATION, MY DEPARTMENT AND THE DEPARTMENT OF ENVIRONMENTAL PROTECTION STAND READY TO COOPERATE.

THANK YOU.

LIST OF ATTACHMENTS

to testimony of Richard Hluchan, DAG
New Jersey Department of Law and Public Safety*

REFERRED TO IN WRITTEN TESTIMONY

TABLE:	1977 US Air Pollution Emission Inventory for Criteria Pollutants
CHART 1:	Sulfur Dioxide Emissions for Coal and Oil Fired Power Plants for States East of the Mississippi River
CHART 2:	Sulfur Dioxide Emissions per Unit of Electrical Energy Generated from Coal and Oil Fired Plants
CHART 3:	Per Capita Sulfur Dioxide Emissions from Coal and Oil Fired Power Plants for States East of the Mississippi River

PROVIDED AS SUPPLEMENTARY INFORMATION

NARRATIVE FOR FILM PRESENTAION: The transport of Photochemical Air Pollution

Example of Sulfur Dioxide Reduction Strategy
(5 pages including 2 tables)

CHART: Average Monthly Residential Electric Bills for States East of the Mississippi River, Jan. 1, 1980

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* Attachments provided by the New Jersey Department of Environmental Protection June, 1981.

1977 US Air Pollution Emissions Inventory
for Criteria Pollutants (percent)

Source	Characteristics	CO	VOC*	NO_2 Nitrates	SO_2 Sulfates
Point	Large & localized	9	47	59	97
Area	Small & widespread	7	13	1	0
Mobile	Small & widespread	84	40	40	3
Air Quality sensitivity to individual control strategies		High	Low	Low	High
Transported range		Short	Long	Long	Long

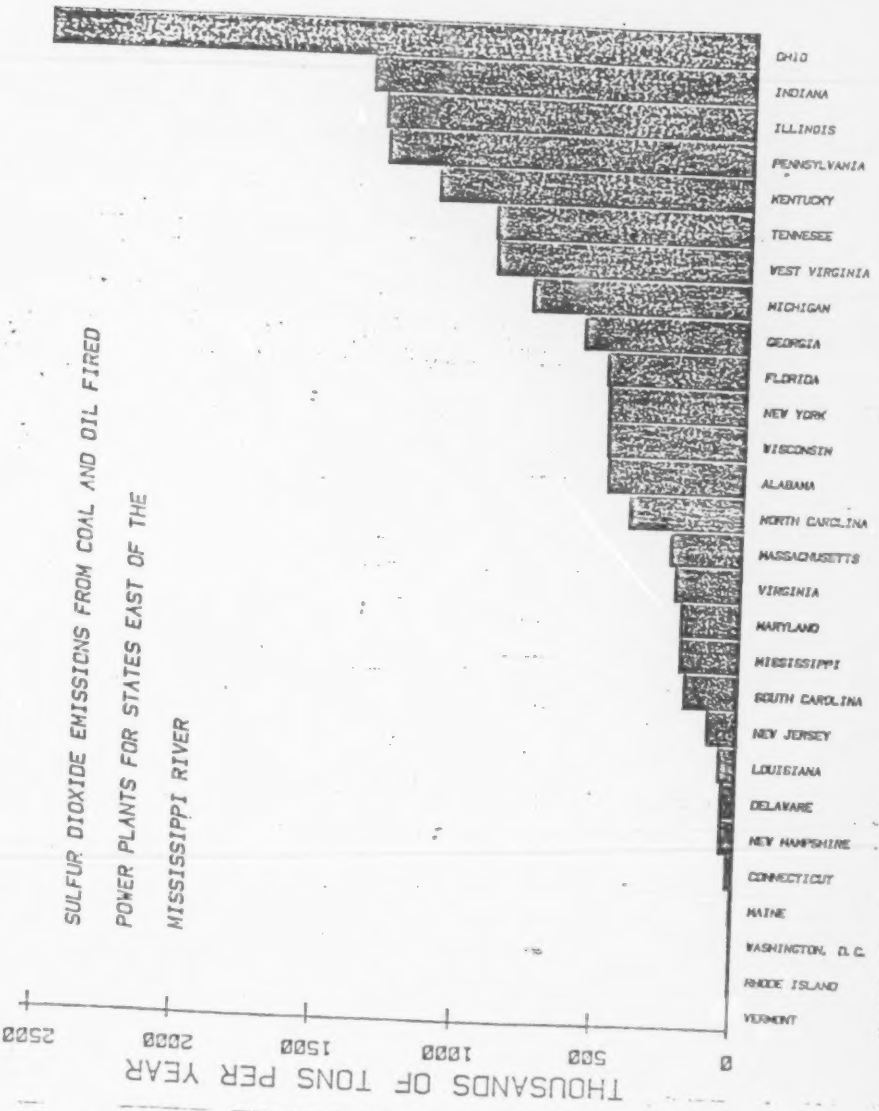
* Volatile Organic Substances

New Jersey Department of Environmental Protection

June 1981

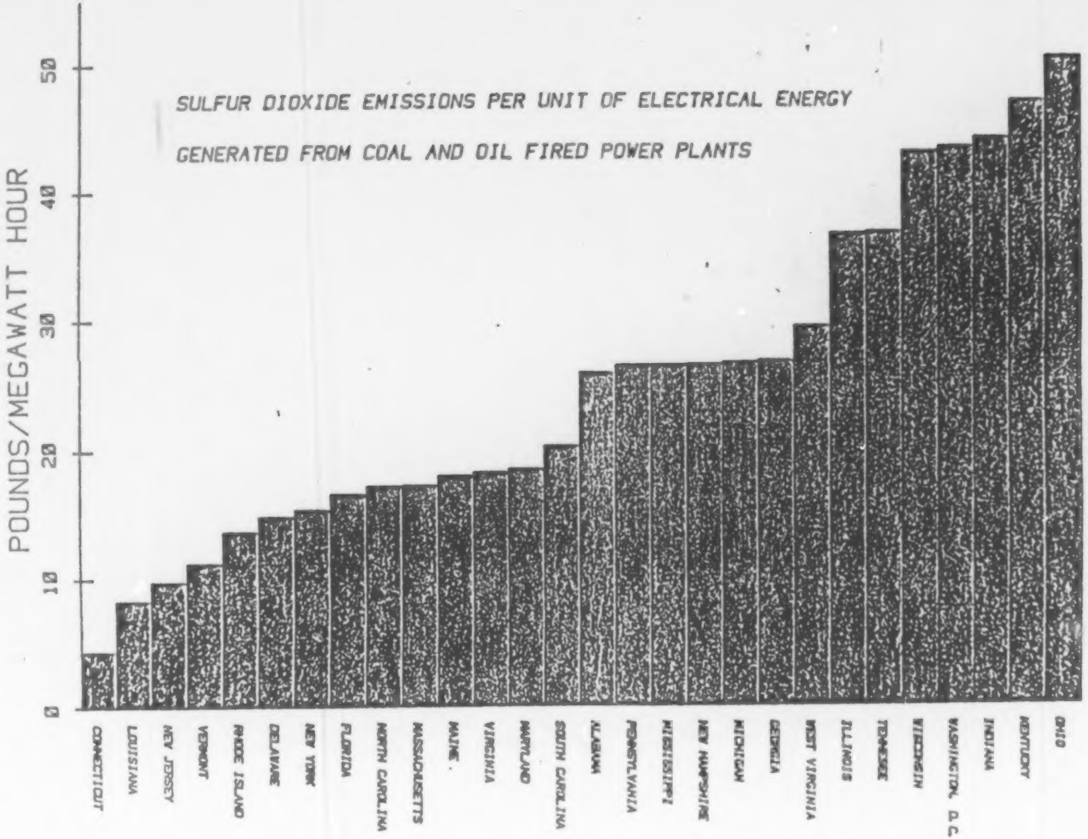
CHART 1

SULFUR DIOXIDE EMISSIONS FROM COAL AND OIL FIRED POWER PLANTS FOR STATES EAST OF THE MISSISSIPPI RIVER



New Jersey Department of Environmental Protection June 1981

CHART 2

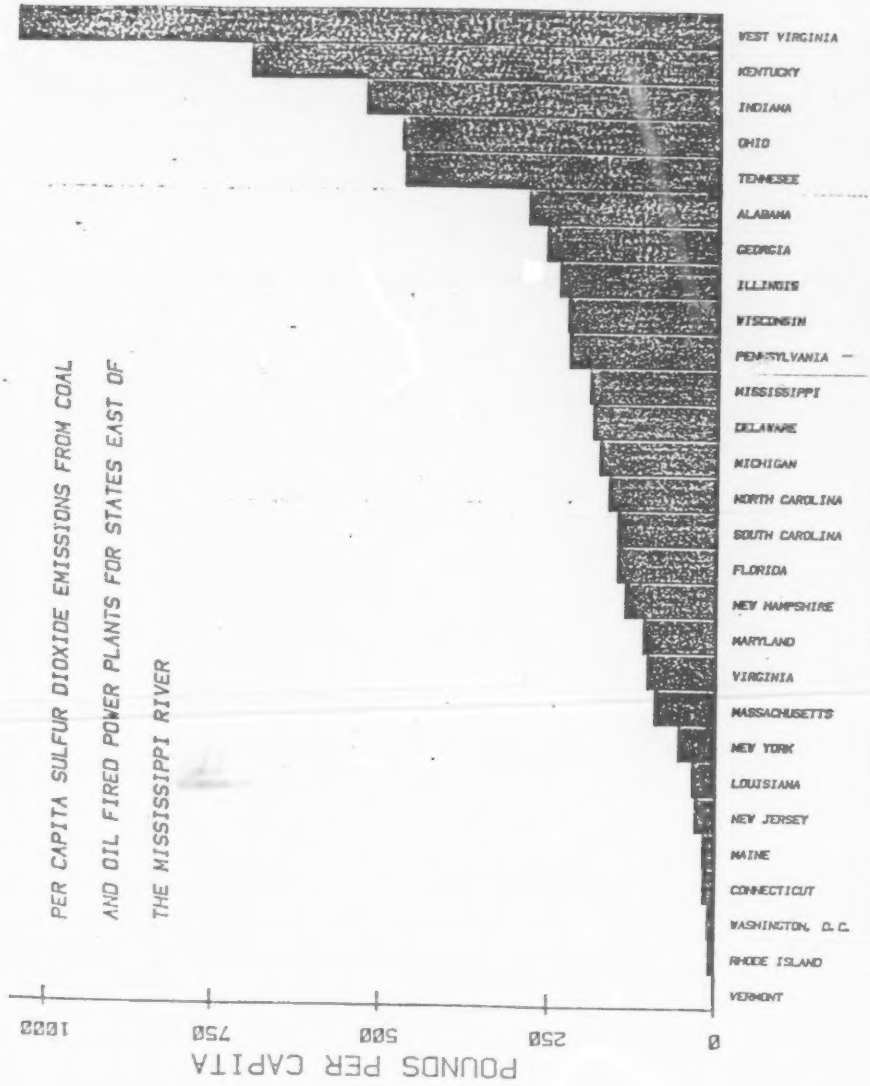


SULFUR DIOXIDE EMISSIONS PER UNIT OF ELECTRICAL ENERGY GENERATED FROM COAL AND OIL FIRED POWER PLANTS

New Jersey Department of Environmental Protection, June 1981

CHART 3

PER CAPITA SULFUR DIOXIDE EMISSIONS FROM COAL AND OIL FIRED POWER PLANTS FOR STATES EAST OF THE MISSISSIPPI RIVER



New Jersey Department of Environmental Protection June 1981

THE TRANSPORT OF PHOTOCHEMICAL AIR POLLUTION*

At Bell Telephone Laboratories, research in atmospheric chemistry is carried out to assess the functioning of telephone equipment in polluted atmospheres. The film is based on a Bell Laboratories study which is described in the article "Photochemical Air Pollution: Transport from the New York City Area into Connecticut and Massachusetts." This article appeared in the journal Science on January 16, 1976, and was written by William S. Cleveland, Beat Kleiner, Jean E. McRae, and Jack L. Warner.

The film illustrates the transport of photochemical air pollution in the northeastern United States. On July 2, 1974, primary emissions in the New York City metropolitan region and winds steadily blowing from the southwest to the northeast, resulted in the transport of photochemical air pollution into central Connecticut in the early afternoon, into northern Connecticut in the late afternoon, into southern Massachusetts in the early evening, and into northern Massachusetts in the late evening.

In the film, ozone concentrations at sites in New Jersey, New York, Connecticut, and Massachusetts, beginning on the morning of July 2, are portrayed by circles on a map of the Northeast. A clock at the lower right hand corner of the screen shows the time of day. Larger circles mean higher concentrations of ozone. A circle the same size as the face of the clock has a concentration of 80 parts per billion, the present Federal Standard for ozone. The present standard is 120 parts per billion, 50% higher.

The sequence will be shown to you twice. In the first showing, time progresses more slowly than in the second.

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*Read into record prior to film presentation.
Text provided by Bell Telephone Laboratories and edited by New Jersey Department of Environmental Protection, June 1981

Revised: August 28, 1981

EXAMPLE SULFUR DIOXIDE REDUCTION STRATEGY

An examination of sulfur dioxide (SO_2) emissions from coal and oil fired power plants for states east of the Mississippi indicates that 35 percent of the states produce 74 percent of the total SO_2 emissions. Since many states are already near the limits of practical emission reduction, it falls to the larger contributors to produce significant overall regional reductions.

This example strategy assumes that states emitting more than 220 pounds of sulfur dioxide per capita per year will be required to reduce their SO_2 emissions through the application of control technology. In effect, their individual reductions will result in a total percentage reduction when applied to emissions from all states.

Table 1 compares 1978 SO_2 emissions for coal and oil fired electrical generation from all states east of the Mississippi to states where SO_2 production exceeds 220 lbs/person/year.

Table 2 lists individual state SO_2 emissions from oil and coal fired power plants and the emission reductions necessary to produce a 20 percent and 10 percent overall SO_2 reduction throughout the entire region east of the Mississippi.

To put these emissions reductions in perspective, note that a 500 MW coal fired generating station burning 3 percent sulfur coal at 65 percent capacity with no controls emits 75,000 tons of SO_2 per year.

TABLE 1*

	SO2 Emissions In Millions of Tons Per Year
ALL STATES EAST OF THE MISSISSIPPI	15
STATES EXCEEDING 220 LBS/PERSON/YEAR*	11

*Pennsylvania, Wisconsin, Illinois, Georgia, Alabama, Tennessee, Ohio, Indiana, Kentucky, West Virginia.

SOURCE: Pacific Environmental Services, 1978 Emissions Inventory

TABLE 2*

State	Total SO_2 Emissions Tons/Year	Emission Reduction Needed for 20% Total State Reduction Tons Per Year	Emission Reduction Needed for 10% Total State Reduction Tons Per Year
Penna.	1,306,500	353,000	176,500
Wis.	494,600	134,000	67,000
Ill.	1,317,800	360,000	180,000
Ga.	589,400	160,000	80,000
Ala.	490,500	132,000	66,000
Tenn.	918,300	248,000	124,000
Ohio	2,516,200	680,000	34,000
Ind.	1,364,600	370,000	[illegible]85,000
Ken.	1,121,200	300,000	150,000
W. Va.	913,100	250,000	125,000
Total	11,032,000	2,990,000	1,495,000

*SOURCE: New Jersey Department of Environmental Protection, June, 1981

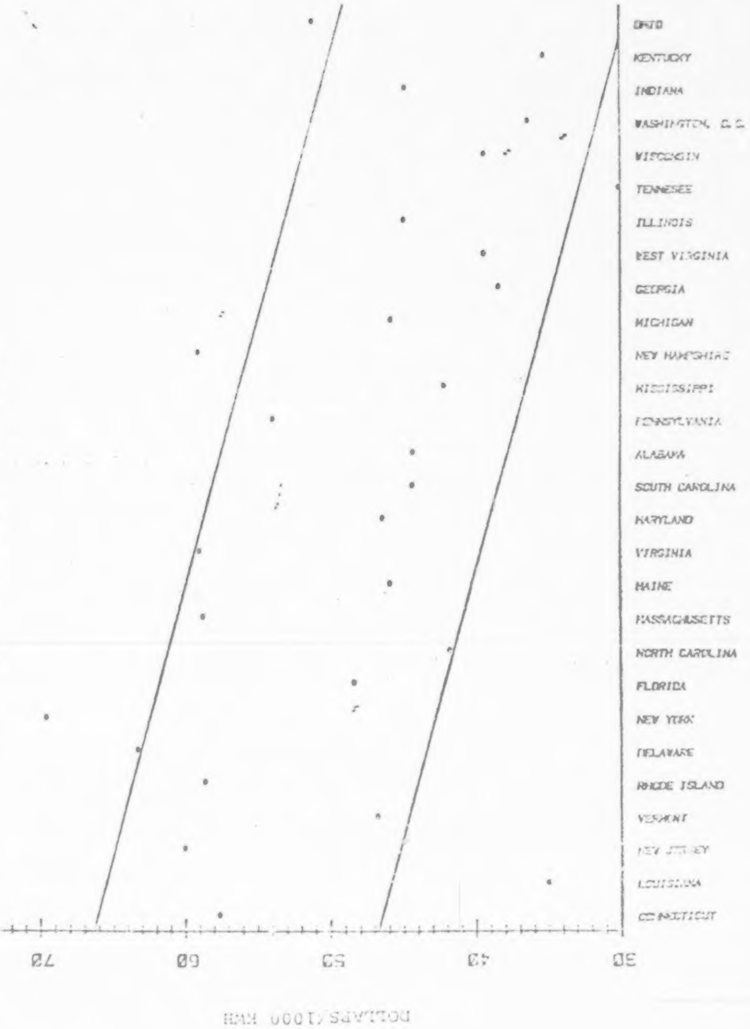
The cost estimates are based on a model scrubber designed to achieve 85% control for a 500 megawatt power plant burning 3% sulfur coal at an average load factor of 65%. The total annualized cost for this unit is $20,540,000. The total cost burden for each state is assumed to be distributed only over the coal and oil fired generating capacity within the state. Since coal and oil fired power generation ranges between 60 and 98 percent of total capacity, this approach may over estimate the cost impact for states that enjoy significant gas fired, hydroelectric, or nuclear power sources.

The increase in monthly residential electric bills will range between $1.12 and $2.19 assuming monthly energy consumption to be 1,000 KWH. This increase only partially offsets the present cost advantage that exist in those states that would be required to achieve the emission reductions. The average residential bill (assuming 1,000 KWH) for those 10 states above 220 pounds SO_2 per capita is approximately $7.00 per month less than the average for the remaining states east of the Mississippi.

Conclusion

States east of the Mississippi with high SO_2 emission rates are able to produce low cost electrical power in part by using inexpensive fuels with little or no environmental controls. These states produce the major portion of the SO_2 pollution burden which is being dispersed over neighboring states. Control strategies which produce 30-90 percent SO_2 removal are available. Adoption of control measures by major emitters will increase the cost of electricity to consumers by a small factor when compared to the higher electric rates incurred by states already shouldering the cost stringent emission controls.

AVERAGE MONTHLY RESIDENTIAL ELECTRIC BILLS
FOR STATES EAST OF THE MISSISSIPPI RIVER
JANUARY 1, 1980



INTERSTATE AIR POLLUTION and THE CLEAN AIR ACT

Testimony of Robert Abrams
Attorney General of the State of New York

Presented by

Mary L. Lyndon
Assistant Attorney General

before the

U.S. Senate Committee on the Environment and Public Works

June 30, 1981, Randolph, Vt.

The fact that air pollution travels among the states is commonly accepted. The most elementary principles of meteorology demonstrate that it occurs. Moreover, serious health and economic problems are caused by transboundary air pollution and these will not cease if they are ignored. Since the 1977 Amendments to the Clean Air Act, EPA has avoided this problem by interpreting too narrowly its authority under the Act. Therefore, Congress must now restate more clearly its earlier mandate to EPA to regulate interstate pollution. The Attorney General of New York urges it to do so.

New York has had experience in trying to get EPA to address one of the most pressing interstate pollution problems - sulfur dioxide and particulate emissions from large midwestern power plants. I will first describe New York's efforts and then suggest two complimentary legislative proposals. Specific language implementing these proposals will be submitted to the Committee by September 1981.

NEW YORK'S EXPERIENCE WITH INTERSTATE POLLUTION LITIGATION

Sulfates have been shown to have serious adverse effects on human health. They are major contributors to acid deposition and precipitation, which damages wildlife, water quality, forests, crops and materials. They also contribute to poor visibility, which has both economic and social effects.*

Several parts of New York do not meet the national primary air quality standard for Total Suspended Particulates (TSP), while other areas do not meet the secondary standard for TSP. New York has generally high ambient sulfate levels. Local New York sources do not account for these pollution levels.

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*The annual economic cost of acid rain in the eastern third of the United States has been estimated at five billion dollars (1978). Statement by Thomas D. Crocker, Professor of Economics, University of Wyoming, Laramie, before this Committee and the U.S. Senate Small Business Committee, September 23, 1980. In part because of acid rain's severe damage to the Adirondack Mountains and Park area, New York is absorbing a large share of these costs.

Sulfates are formed in part from sulfur dioxide (SO_2) emissions which are transformed in the atmosphere. The largest concentration of SO_2 emissions in the U.S. is located in the Ohio River Basin, upwind of New York State in the area's predominant meteorological patterns.

In January of this year and again in March, the Attorney General of New York filed with EPA formal petitions concerning the emissions of 24 large power plants in six midwestern states. New York requested EPA to disapprove pending SIP revisions which would increase allowable sulfur dioxide emissions by these power plants. New York's petitions pointed out to EPA that §§ 110(a)(2)(E) and (a)(3) of the Act require EPA to make a determination that no interstate air pollution will be caused before EPA may approve a SIP or SIP revision. EPA has never conducted an overall review of the SIPs for interstate effects, even though this was clearly contemplated by the 1977 Amendments to the Act. Nor has EPA required states to list potential major sources of interstate pollution as § 126(a) requires. New York therefore petitioned EPA to identify and assess the cumulative effects of midwestern sulfur dioxide emissions.

Since New York filed its petitions, EPA has approved a number of the SIP revisions which allow increased SO_2 emissions. EPA did not assess the interstate impacts of these revisions. New York is seeking review of EPA's actions in the federal courts.

In the meantime, EPA has instituted a proceeding, pursuant to § 126(b) of the Act, on the impacts of the emissions of the nineteen plants which were the subject of New York's original petitions. This proceeding is being held jointly with Pennsylvania. (In late 1980 Pennsylvania filed a petition respecting approximately 30 resources of sulfur dioxide in Ohio and West Virginia.)

EPA has defined the scope of this § 126(b) proceeding so as to preclude consideration of the cumulative impacts of the emissions allowed by the midwestern SIPs. EPA is also refusing to consider sulfate effects and acid deposition and precipitation.

A hearing was held on June 18 and 19, 1981. New York, Pennsylvania, Massachusetts, the Providence of Ontario and many other interested parties submitted extensive testimony. The testimony presented demonstrates clearly that sulfur pollutants are being transported in large amounts from midwestern states into Pennsylvania, New York, and New England. The overwhelming bulk the testimony supported the finding of the National Commission on Air Quality (NCAQ), which stated in its report to Congress:

> In recent years, air pollutants transported long distances from emitting sources have been recognized to have effects that are not mitigated adequately by meeting air quality standards in the vicinity of the source of the pollution.

> Several problems have been found to be associated with long-range pollutant transport transcending political jurisdictions. Among the most serious are acid deposition (including acid rain and dry deposition of acid), the deterioration of visibility on a regional scale, the transport of ozone and ozone precursors between neighboring areas, and the increasing amount of interstate air pollution. All of these effects can hinder efforts to improve air quality through existing state and local regulatory programs.
>
> NCAQ, To Breath Clean Air, 1981, p. 3.9-1.

The NCAQ found that sulfate particles can be transported to areas 1,000 kilometers from the sources and contribute to particulate loading, acid deposition and visibility impairment. Ibid., at 2.1-69 & 70. No testimony presented at the EPA hearing contradicted this assertion. Only the ability to quantify the contribution of midwestern sources to eastern pollution was questioned by some commenters in the proceeding..

New York will submit to the Committee the final testimony of Dr. Perry Samson, who described the recent work he has done to identify the sources of New York's sulfate pollution. This work was corroborated today in the testimony given before the Committee by Dr. Robert Friedman of the Congressional Office of Technology Assessment. Dr. Friedman testified that the most sophisticated models of long-range transport of air pollution indicate that 70% of New York State's ambient sulfate pollution originates outside of New York.

Studies conducted by EPA, by independent academic researchers, by the New York State Department of Environmental Conservation and by numerous other state agency sources all lead to the same conclusion: air moves long distances from the Midwest and carries sulfur pollution with it. Consideration of this basic fact must be incorporated into the SIPs of all the states. In 1977 Congress directed EPA to implement the new interstate provisions of the Act, but EPA has not done so. Congress must restate these directions more clearly.

PROPOSED REVISIONS TO THE ACT

The Act as it is presently written contains an adequate basic structure to deal with most interstate problems, if they are addressed through the Act's processes from the onset of the problem. Therefore, New York proposes a two-pronged legislative approach to address interstate air pollution. First, the Act's processes should be retained essentially as they are, but with some essential changes in language. Second, for those serious pollution problems which have gone unchecked during the past, New York proposes direct immediate legislative action to control emissions.

Clarification Of The Existing Interstate Provisions

The Act contains three basic processes for controlling interstate air pollution. New York proposes to make each one more explicit.

1. Section 110(a)(2)(E). The states and EPA must each have clear responsibility to prevent interstate problems, through careful SIP preparation and review. The Act presently requires that each SIP be written so as not to prevent attainment or maintenance or interfere with the PSD program in another state. However, the present language of § 110(a)(2)(E) has been construed in ways that would deprive it of all meaning. A few phrasing adjustments would make it clearer that the section requires states to set their sources' emission limits at levels which will not burden downwind states and that EPA may not approve a SIP which will cause inequities among the states.

2. National Ambient Air Quality Standards. It should be made clearer that it is EPA's responsibility to establish NAAQS which incorporate interstate considerations, including meteorological transport patterns, chemical transformations in the atmosphere and synergism, and the impacts of different deposition mechanisms, such as rain. NAAQS must be established for pollutants which do not cause problems "locally", i.e., in the immediate area of emission, but cause

damage elsewhere. All evidence of interstate transport of pollutants should be considered; where long-range models are useful they should be relied upon, but regulation must not be made to await development of highly specific models where there is other valid evidence. Again, the present language of the Act provides authority for such regulation; the reauthorization of the Act should clarify and highlight it.

3. Section 126. Each state must have the right to petition for a finding of adverse impact from any out-of-state pollution. Congress should revise § 126 so that pollutants which are not presently covered by § 126(b) may be the subject of a state's § 126(b) petition.

New York has very substantial technical expertise in the fields of meteorology, atmospheric chemistry and the health sciences. New York is prepared to present its case on sulfate pollution in a federal forum. It wishes to seek relief from what it believes is a serious threat to New York's health and economy. Yet § 126 allows state to complain only of pollutants which EPA already regulates nationally. The Clean Air Act provides New York, a state of the Union, with less opportunity to present its case than it provides to foreign states. Section 115 of the Act, International Air Pollution, has no restriction on what pollutants may be the subject of its processes. Section 126 is unduly restrictive in this respect. EPA should regulate any pollutants which cause serious regional problems, rather than only addressing national problems.

EPA's approach to local controls has been to rely heavily on air quality modelling which is keyed to the immediate impacts of individual emission sources. This approach cannot be translated into the long-range context. When large numbers of sources emit pollutants which are gathered into the atmosphere and transported to distant areas, their cumulative impact may be very harmful, even though the original emissions were small and caused no harm locally. EPA has refused to act on the overwhelming information which it has that implicates categories of sources as causes of interstate pollution. EPA should be required to control groups of sources on an equitable interstate basis. It must abandon the fiction that any individual sources will be identified as the "cause" of interstate pollution.

Therefore, section 126 should explicitly require EPA to set standards to abate interstate pollution, even when EPA cannot quantify exactly the extent of the problem or establish particular source-receptor ties. EPA should be required to abate any identified interstate pollution problem by setting a technology-based emission standard, established on a basis of equity among the states.

Controlling Existing Pollution

Apart from enlarging the scope of § 126, the proposals offered above would leave the Act basically the same. However, we also need direct controls on emissions which are now causing interstate pollution. New York urges the adoption of measures to reduce sulfur pollutants emitted by midwestern power plants. Many of these plants are very large and many exercise little or no control over their emissions. New York controls its emissions very strictly. The midwestern states should do likewise.

Midwestern states contribute a high percentage of the total U.S. SO_2 emissions. An analysis of emissions monitoring and meteorologic data for eastern United States shows that the most likely sources for sulfur dioxide and sulfate pollutants in the east are the concentration of coal-fired electric power plants in the midwestern states of Ohio, West Virginia, Indiana, Illinois, Michigan, Kentucky and Tennessee. The emissions from these states dwarf those of New York and the New England states. The presence of high sulfate levels in New York and New England is inconsistent with the relatively low local emission rates and can only be explained as resulting from the large SO_2 emissions in the upwind midwestern states.

For example, in 1978 the states of Illinois, Indiana, Michigan, Ohio, Tennessee, Kentucky and West Virginia emitted approximately 11.3 million tons per year. In comparison, combined emissions from New York, New Jersey and all the New England states totaled only approximately 2 million tons per year. Emissions from Ohio were almost three times higher than total New York SO_2 emissions and the Ohio emissions exceeded by 50% the combined total of the New York, New Jersey and all New England states. The allowable SO_2 emissions in the midwestern states are greater than those in the Northeast. When coupled with the numbers and sizes of the plants, the result is a huge dump on downwind states.

Substantial reductions in SO_2 emissions can be achieved in the midwestern United States. It has been estimated that 2.5 to 3.3 million tons of sulfur dioxide per year could be eliminated by the imposition of sulfur dioxide emission limits similar to those in effect in Pennsylvania and western New York (4 pounds SO_2 per million BTU). There are at least 68 plants located primarily in Illinois, Indiana, Kentucky, Ohio and West Virginia which are currently emitting at a higher rate. National Commission on Air Quality, To Breathe Clean Air, at pp. 319-26.

New York's Attorney General supports a national or regional emissions cap or a regionally targeted sulfur dioxide rollback provision. New York has imposed stringent controls on its SO_2 sources, at great cost to its economy. Congress should direct a firm, gradual move by other states in the same direction.

New York's Attorney General supports a two-step process. The first step would be a mandate of direct and immediate controls on the largest emitters of SO_2, which should be clearly identified in the statute. The reductions could be accomplished through any means, including local offsets, but there must be a specific numerical reduction in emissions. The second step would be a long term rollback by each state to a national emissions cap. Implementation of this program will be eased by the development of improved coal washing, retirement of old plants, energy conservation, and new markets for dirty coals, such as synfuels. The second strategy must be firmly stated, however, to establish a setting for these developments to occur. Also, it should be completed no later than 1990.

Finally, New York urges Congress to direct EPA to firmly control related pollutants such as nitrogen oxides and hydrocarbons. Power plant controls on NO_x emission should be mandated and automobile controls should be strictly maintained. These pollutants cause interstate problems all over the country; increasingly severe damage is resulting from lack of controls, particularly in the eastern states.

Under the Constitution of the State of New York the Attorney General is responsible to seek legal redress where necessary to protect New York's citizens. The state needs strong, clear, specific federal laws to address interstate problems such as the long-range transport of air pollutants. These problems cannot be addressed on the local and state levels alone, but must be handled in a national framework. It is the task of Congress to give coherent directions to the EPA to face these difficulties and resolve them to the best of its ability. The Attorney General of New York urges Congress to reiterate its 1977 mandate to EPA.

This concludes my testimony. The Attorney General of New York will submit to the Committee proposed legislative language articulating these proposals.

TESTIMONY OF CHAUNCEY H. BROWNING, ATTORNEY GENERAL OF WEST VIRGINIA, TO SENATE SUBCOMMITTEE CONCERNING REAUTHORIZATION OF THE CLEAN AIR ACT, SECTION 126

Submitted by

RONALD A. SHIPLEY
ASSISTANT ATTORNEY GENERAL
State Capitol
Charleston, West Virginia

GOOD AFTERNOON LADIES & GENTLEMEN:

I AM RON SHIPLEY AN ASSISTANT ATTORNEY GENERAL REPRESENTING CHAUNCEY H. BROWNING, ATTORNEY GENERAL OF WEST VIRGINIA. IT IS A PRIVILEGE TO BE HERE TODAY TO DISCUSS THE INTERSTATE PROVISIONS OF THE CLEAN AIR ACT.

AT THIS TIME WHEN THE CLEAN AIR ACT IS PENDING REAUTHORIZATION AND THERE IS MUCH DISCUSSION OF DECREASING THE FEDERAL ROLE IN AIR POLLUTION CONTROL, WE ARE HERE TO TELL YOU THAT § 126 MUST NOT BE WEAKENED. INDEED, DEPENDING ON THE OUTCOME OF THIS YEAR'S REAUTHORIZATION, THE INTERSTATE POLLUTION ABATEMENT SECTION MAY EVEN NEED TO BE EXPANDED.

IT IS DIFFICULT TO PUT FORTH PROPOSALS TO AMEND SECTION 126 OF THE ACT WHEN WE ARE NOT SURE HOW OR WHETHER OTHER PROVISIONS OF THE ACT WILL BE CHANGED. THE CLEAN AIR ACT IS AN INTRICATE, INTERRELATED PIECE OF LEGISLATION. BUT, TO THE EXTENT EPA's ROLE IS REDUCED IN FAVOR OF GREATER STATE CONTROL, ANY INTERSTATE POLLUTION ABATEMENT MECHANISM IN THE ACT INTENDED TO HELP THE STATES RESOLVE THEIR INTERSTATE POLLUTION PROBLEMS MUST BE BROADENED.

WEST VIRGINIA HAS FILED A § 126(b) PETITION AND IS PRESENTLY DEFENDING AGAINST TWO OF THEM. WE KNOW SECTION 126 IS AN IMPORTANT MECHANISM FOR TRYING TO RESOLVE AN INTERSTATE AIR POLLUTION PROBLEM.

OUR EXPERIENCE IN FILING § 126 PETITIONS IS LIMITED BECAUSE WE NEVER GOT TO THE HEARING STAGE. AFTER WE FILED A § 126 PETITION AGAINST THE SAMMIS POWER STATION IN OHIO, WE INTERVENED IN A U.S. EPA ENFORCEMENT ACTION AGAINST

SAMMIS AND ACHIEVED THE INTENDED RESULTS. BUT THIS EXPERIENCE, COUPLED WITH OUR PRESENT DEFENSIVE POSTURE CONCERNING NEW YORK AND PENNSYLVANIA'S RECENT § 126 PETITIONS HAS SHOWN US HOW § 126 WORKS.

FOR SIMPLICITY OF DISCUSSION, THERE APPEARS TO BE TWO KINDS OF INTERSTATE AIR POLLUTION PROBLEMS. THE FIRST IS THE SITUATION WE ENCOUNTERED AT SAMMIS, I.E., A DIRECT AND READILY TRACEABLE SHORT RANGE INTERSTATE POLLUTION PROBLEM. THE EXISTING CLEAN AIR ACT, WITH CERTAIN CLARIFICATIONS, ADDRESSES THIS SITUATION ADEQUATELY.

THE SAMMIS POWER STATION SITUATION IS IDEAL FOR A § 126 PETITION. IN THAT SITUATION WE PETITIONED AGAINST A SINGLE SOURCE WHOSE IMPACT ON WEST VIRGINIA WAS VISIBLE AND EASILY TRACEABLE. MATHEMATICAL MODELING WAS NOT NECESSARY. WE MERELY MONITORED AIR QUALITY AND TOOK PICTURES OF THE SAMMIS PLANT'S PLUME ORIGINATING ACROSS THE OHIO RIVER AND DEPOSITING AIR POLLUTANTS ON THE HILLS OF WEST VIRGINIA. AT THE OTHER EXTREME IS THE NORTHEASTERN STATES' PROBLEMS WITH NOT EASILY TRACEABLE LONG RANGE TRANSPORTATION OF A POLLUTANT (SULFATES) WHICH IS NOT INCLUDED IN THE NATIONAL AMBIENT AIR QUALITY STANDARDS, PSD OR VISIBILITY REQUIREMENTS.

SECTION 126's USEFULNESS FOR EITHER OF THESE SITUATIONS, AND ESPECIALLY THE MORE COMPLEX PROBLEMS SUCH AS NEW YORK'S AND PENNSYLVANIA'S PETITIONS IS COMPLICATED DUE TO UNCERTAINTIES OVER KEY QUESTIONS AND THE DIFFICULT TECHNOLOGICAL ISSUES INVOLVED. INITIALLY WE URGE CONGRESS TO CLARIFY EXISTING § 126 TO ENHANCE ITS USEFULNESS BY STATES AND POLITICAL SUBDIVISIONS. THOSE AREAS NEEDING CLARIFICATION INCLUDE: (1) WHO HAS THE BURDEN OF PROOF; (2) WHAT MUST A PETITIONING STATE SHOW TO

TRIGGER THE EPA INVESTIGATIVE PROCESS; (3) WHETHER SOURCES CAN BE AGGREGATED; AND (4) WHAT IS A MAJOR SOURCE?

FIRST, CONGRESS SHOULD SPECIFY THAT EPA - NOT THE PETITIONING STATE - HAS THE BURDEN OF SHOWING IMPERMISSIBLE INTERSTATE EFFECTS. THE LAW ALREADY IMPLIES THIS BURDEN SINCE EPA MUST UNDERTAKE THE RULEMAKING. HOWEVER, THERE HAVE BEEN MANY QUESTIONS RAISED CONCERNING THE BURDEN OF PROOF, ESPECIALLY IN LIGHT OF THE LIMITED TIME PERIOD OF SIXTY (60) DAYS IN WHICH EPA MUST ACT. SOME SAY THIS SHORT TIME PERIOD IMPLIES THAT THE PETITIONERS MUST COME TO EPA WITH A CONCLUSIVE CASE SHOWING IMPERMISSIBLE INTERSTATE EFFECTS. WE DO NOT AGREE. EPA HAS THE BURDEN TO INVESTIGATE A LEGITIMATE INTERSTATE POLLUTION CLAIM.

WHILE THE ULTIMATE BURDEN IS ON EPA, THE STATE OR POLITICAL SUBDIVISION MUST COME FORWARD WITH MINIMUM SHOWINGS OF A LEGITIMATE INTERSTATE POLLUTION CLAIM TO TRIGGER THE INVESTIGATIVE PROCESS. WE WANT TO PUT SOME BURDEN ON THE STATE TO GIVE ALL PARTIES AFFECTED, INCLUDING THE NAMED SOURCES, ENOUGH INFORMATION TO SHOW WHAT IMPERMISSIBLE IMPACTS ARE OCCURING. THIS WILL ENHANCE THE FACT FINDING PROCESS BECAUSE OTHER PARTIES WOULD KNOW THE SPECIFICS CONCERNING THE ALLEDGED INTERSTATE PROBLEM. THEREFORE, CONGRESS SHOULD SPECIFY THE MINIMUM ALLEGATIONS A PETITIONING STATE OR POLITICAL SUBDIVISION MUST MAKE TO TRIGGER THE EPA INVESTIGATIVE PROCESS. THESE ALLEGATIONS SHOULD:

(1) SHOW EVIDENCE OF NONATTAINMENT;

(2) SHOW THAT NONATTAINMENT IS CONTRIBUTED IN SIGNIFICANT (NOT DE MINIMIS) AMOUNT BY OUT-OF-STATE POLLUTANTS;

(3) SHOW THAT NONATTAINMENT IS NOT CAUSED BY IN-STATE SOURCES;

(4) SHOW EVIDENCE THAT THE NON-LOCAL POLLUTANTS ARE FROM THE NAMED SOURCES.

THIRD, WE UNDERSTAND THAT THE NATIONAL COMMISSION ON AIR QUALITY HAS RECOMMENDED THAT THE ACT BE CLARIFIED TO ENSURE THAT SOURCES CAN BE AGGREGATED FOR SECTION 126 PURPOSES. WE SUPPORT THAT RECOMMENDATION BUT ONLY IF IT IS MADE CLEAR THAT AGGREGATION OF SOURCES IS ALLOWED ONLY AFTER EACH INDIVIDUAL PLANT IS SHOWN TO CONTRIBUTE TO INTERSTATE LOADINGS. IF NOT, THEN THAT SOURCE SHOULD NOT BE INCLUDED IN THE AGGREGATE. WE BELIEVE THAT THE PRESENT LAW CURRENTLY ALLOWS FOR THIS TYPE OF AGGREGATION BUT CONGRESS SHOULD CLARIFY ITS INTENT.

FINALLY, WE BELIEVE IT IS IMPORTANT TO DEFINE WHAT IS A MAJOR SOURCE FOR PURPOSES OF § 126(b). CURRENTLY IT IS NOT DEFINED AND EVERYONE ASSUMES THAT THE MAJOR SOURCE DEFINITION FROM THE PSD SECTION APPLIES. BUT WE ALSO QUESTION WHETHER ANY "MAJOR" CLASSIFICATION IS NEEDED. IF A SOURCE, LARGE OR SMALL, IS VIOLATING AMBIENT AIR QUALITY STANDARDS IN ANOTHER STATE IT ALSO SHOULD BE THE SUBJECT OF A § 126(b) PETITION. FOR EXAMPLE, IF THE SAMMIS PLANT WERE NOT A MAJOR SOURCE, WE WOULD NOT WANT TO BE PRECLUDED FROM THIS FORUM.

AS WE HAVE INDICATED, IF EPA'S ROLE IN AIR POLLUTION ABATEMENT IS REDUCED, CONGRESS MUST PROVIDE A CONVENIENT, PRACTICAL FORUM FOR THE STATES TO RESOLVE INTERSTATE PROBLEMS. CONSEQUENTLY, § 126 MIGHT HAVE TO BE EXPANDED AND OTHER MECHANISMS INCLUDED IN THE ACT.

THIS COULD BE ACCOMPLISHED BY ADDING A SUBSECTION TO § 126(b). THIS NEW SUBSECTION WOULD BROADEN THE EXISTING

§ 126(b) MECHANISM CONSISTENT WITH THE CONCEPTS THAT ONE STATE CAN PETITION FOR A FINDING THAT AN OUT-OF-STATE SOURCE OR SOURCES CONTRIBUTES ANY POLLUTANT IN SUFFICIENT QUANTITIES TO ENDANGER PUBLIC HEALTH OR WELFARE. IF SUCH EXPANSION IS WRITTEN INTO LAW, THEN CONGRESS COULD TIE EPA ACTION FOR A NON-CRITERIA POLLUTANT WHICH CAUSES ADVERSE PUBLIC HEALTH OR WELFARE IMPACT INTO § 108 - "AIR QUALITY CRITERIA AND CONTROL TECHNIQUES" OR CONGRESS COULD ALLOW EPA TO SET "REGIONAL AMBIENT AIR QUALITY STANDARDS" FOR THAT POLLUTANT. FINALLY, CONGRESS MIGHT WANT TO SET UP A NEGOTIATION-ARBITRATION MECHANISM INSTEAD OF THE MORE RIGID RULEMAKING PROCESS WHICH NOW TAKES PLACE.

THE PURPOSE BEHIND THESE ADDITIONAL MECHANISMS IS TO AVOID THE INEQUITABLE NATURE OF THE CURRENT § 126(b) PETITION. NEW YORK'S AND PENNSYLVANIA'S PETITIONS COULD LEAD TO INEQUITABLE RESULTS IF EPA GRANTS THE PETITIONS AND THE NAMED SOURCES ARE REGULATED MORE STRINGENTLY. THIS IS INEQUITABLE SINCE THE EVIDENCE INDICATES THAT THE SULFATE PROBLEM IS TRULY REGIONAL AND EMANATES FROM UNNAMED SOURCES AS WELL AS THOSE INCLUDED IN THE PETITION.

IN CONCLUSION, WE SUPPORT THE § 126(b) MECHANISM. WE DO NOT WANT TO SEE IT WEAKENED. CERTAIN CONCEPTS SHOULD BE CLARIFIED. WE WANT § 126(b) TO BECOME A BETTER, MORE PRACTICAL, CONVENIENT FORUM WHICH CAN PROVIDE EQUITABLE SOLUTIONS TO INTERSTATE AIR POLLUTION PROBLEMS.

THANK YOU.

STATEMENT OF BRENDAN J. WHITTAKER, SECRETARY

VERMONT AGENCY OF ENVIRONMENTAL CONSERVATION

My name is Brendan Whittaker. I am the Secretary of the Vermont Agency of Environmental Conservation. I ask that the following comments on the upcoming revision to the Clean Air Act be given full consideration by the Senate Committee on the Environment and Public Works.

In its present form, the Clean Air Act (Act) has been successful in reducing concentrations of certain air pollutants in many sections of the country. There are, however, several deficiencies in the Act which call for improvements during the current session of Congress. These deficiencies are particularly glaring from the perspective of a small, rural state in New England, where the quality of our natural environment is vital to our economy and a part of our way of life.

There are four major areas of concern to Vermont which include: the long range transport of air pollutants (and acid rain), development of a fine particulate (and/or sulfate) standard, retention and improvements to the existing prevention of significant deterioration (PSD) section of the Act, and, finally, a streamlining of the existing state implementation plan (SIP) process.

The first and most important of these issues is the long range transport of air pollutants and acid rain. It is known that over 90% of the world's sulfur dioxide emissions are anthropogenic in origin[1], and that much of this sulfur dioxide is frequently transformed in the atmosphere to sulfate aerosal which may then be transported on the order of 1,000 kilometers from the point of origin.[2] Sulfate, in terms of relative toxicity, ambient concentrations, and population exposure is considered by many health experts to be the single most serious air pollution health problem in the country today.[3] It is known that sulfate is responsible for 50% of the total extinction of light in the atmosphere, causing episodic reductions in visibility throughout the Northeast.[4] Sulfate is the primary acidifying component of acid precipitation in the Northeast and that this acid precipitation is causing dramatic alterations of acquatic ecosystems in poorly buffered areas.[5] Soil chemistry is being altered and the potential damage to crop and forest productivity could be disastrous.[6]

Vermont bears the costs associated with long range transport to a degree way out of proportion to our contribution to the problem. As a state, Vermont emits the smallest quantity of SO_2 of any state in the Eastern United States yet sulfate concentrations in Vermont average 9 to 10 micrograms per cubic meter throughout the state and 24 hour concentrations as high as 44 micrograms per cubic meter have been recorded. These concentrations are comparable to levels recorded in large emission states such as Ohio, Illinois, Pennsylvania[7] and in large urban areas in other sections of the country[8] and are above the levels at which adverse health effects have been observed[9]. Sulfate also makes a substantial contribution to total suspended particulate concentrations in Veront and is at least partially responsible for the failure of our two particulate nonattainment areas to meet national air quality standards.

The combination of sulfate and relative humidity (which causes the tiny hygroscopic sulfate particles to grow in size) explains 60% of the variability in visual range in Burlington visibility data[10]. Similar episodic reductions occur through the state and are likely to have an adverse impact on tourism.

Sulfate is also the primary acidifying component of acid precipitation in Vermont. Rainfall as acidic as 3.2, 150 times more acidic than normal rain (pH 5.6), has been recorded on Mount Mansfield. Monthly averages during July, August, and September of last year ranged between 3.68 and 3.88. Rain with a pH of 4.0 or less have been recorded at every monitoring station throughout the state.[11] Since May 5 of this year, the mean weighted pH of precipitation collected at the State's National Atmospheric Deposition Station in Bennington has been 3.78, 65 times more acidic than normal. This station is just upwind of one of the most poorly buffered sections of the State.

There are several large areas of the state which contain lakes which are particularly susceptible to effects of acid precipitation. These include the southern Green Mountains and the extreme northeastern portion of the state. Additional areas include all high elevation areas (above 2000 feet) and any additional areas underlain by resistant granitic bedrock.[12]

Some high elevation lakes, ponds, and streams have already been impacted and exhibit pH readings of less than 5.0 and negative alkalinities. The addition of strong acids from atmospheric deposition is the only reasonable explanation which can account for these alarming results. There are at least five water bodies (total 90 acres) in the state which fall into this "critically acidified" category. These are considered to be incapable of supporting viable fisheries, and unsuitable for use as public water supply.[13]

A second group of 45 Vermont water bodies encompassing some 6,559 acres can be classified as endangered. These lakes have alkalinities of less than 5 and have essentially lost their ability to neutralize continued acid loadings.

A third group of 34 water bodies encompassing 3,692 acres have alkalinities between 5 and 10 and are considered to be potentially susceptible to damage from continued acid loadings.[14]

Not only must Vermont bear the costs of sulfate transport due to health effects, particulate nonattainment, visibility reductions, and acid rain, but these costs are compounded by the fact that regional differences in pollution control requirements make the costs of pollution control substantially more expensive in New England than in those states which contribute most to the problem.[15] This places us at a severe disadvantage in terms of attracting new industry to the state.

Sulfate is not the only pollutant transported into Vermont. Other small particles including heavy metals like lead, copper, and zinc are accumulating at an alarming rate in our forest soils.[16]

Violations of national air quality standards for ozone have been recorded in three areas of Vermont again due to transport.[17] These violations have forced inequittable control requirements on many of our small local hydrocarbon sources while many of the larger upwind emitters who contribute most to the ozone problem are free from control requirements. This puts our local industries at a substantial competitive disadvantage and is a deterent to new industry seeking to locate here.

Certain air pollutants including but not limited to sulfate, other fine particulate, and ozone must be viewed as regional rather than local problems. Emission standards for sulfur dioxides, fine particulate, hydrocarbons, and oxides of nitrogen should be applied throughout the entire region rather than just in those downwind states where the problem surfaces. To mitigate the effect of long range air pollution, the following available measures are called for:

1. Immediate designation by U.S. EPA of regional corridors in which long range pollutant transport is occurring.

2. Immediate enactment of mandatory coal washing (or cleaning) for all utilities burning more than two percent sulfur coal.

3. No net increase in emissions from oil-fired power plants converting to coal.

4. Retrofit burners to reduce nitrogen oxide emissions on all coal-fired utility boilers.

5. Strict adherence to the "no credit for tall stacks" policy as contained in the present Clean Air Act.

6. Reasonably available control technology on all VOC sources emitting more than 100 tons per year.

7. No relaxation of automotive emission standards as contained in the present Clean Air Act or postponement of their due date.

8. Continue and accelerate research to determine causes and effects of acid rain. An effort should be made to distribute research funds towards those states where damage is occurring.

The second area of concern to Vermont, and one which is directly related to long range transport, is the need for expedient development of a national air quality standard for fine particulates (and/or sulfates).

Many areas of the country are designated as nonattainment areas with respect to total suspended particulate (TSP). TSP violations are easy to come by because they are the result of all sizes of particles from less than one micron up to at least 50 microns in aerodynamic diameter. Large amounts of money and scarce resources have been focused on solutions to the problems of TSP violations in a wide variety of localities, ranging from urban areas the size of our largest cities down to rural communities such as are found in Vermont. The result of all this analysis seems to be saying that no matter which type of area one is concerned with, TSP is ubiquitous and is to a great extent the result of a lot of relatively large wind blown soil particles, fugitive large particles otherwise locally entrained in the air. The component of TSP which is fine particulate (less than some size in the range of 1.0 to 3.5 microns) is to a great extent unknown because it is generally not measured. Fine particulates are generally man-made and result from combustion, industrial, and transportation processes. The focus is on TSP, yet health studies indicate that fine particulate is the most damaging and threatening to human health. Past studies relating human health response to TSP levels do not necessarily focus on the proper variable, in that fine particulate is always a component of total suspended particulate. In fact there may be little benefit in reducing TSP by control strategies which target large-particulate emission sources while ignoring fine-particulate sources. On the other hand, controlling a large percentage of the fine particulate may not even get rid of the TSP violations experienced becasue fine particulate comprises such a small part of total mass or weight of TSP (upon which the standard is based). It takes a lot of fine particulates to equal the weight of one large particulate.

Fine particulate then seems to be more dangerous from a health perspective, more easily transported long distances thereby affecting areas or regions not responsible for the actual emissions, and generally likely to be ignored in control approaches because it is both harder to control and yields less credit toward reducing the mass of emissions than control of large heavy particulate does. It is this situation which currently exists and is fostered by the present TSP standard.

We must without unnecessary delay enact a primary NAAQS specifically for fine particulate, retaining the TSP standard as a guideline indicator, or replace the existing TSP standard with a size specific particulate standard that more accurately represents the threat to human health than the existing TSP standard.

Controlling particulate sources to lower ambient TSP levels under present policies does not in any way guarantee ambient air that is somehow better to breath when the quality of that air is measured by a TSP concentration that in itself may have had little to do with increased adverse health effects. Research studies show that fine particulate in the ambient air poses a distinct health hazard that is not now being addressed and that this problem can only get worse under an energy scenario highly dependent on coal use and an increase in diesel fueled engines in our transportation system. Monies and resources allocated to solving existing TSP problems can be better utilized to both identify areas in which fine particulate levels are causing adverse health effects and to develop and implement strategies to solve them. If we do not address the fine particulate problem now, it is likely that the effort to solve existing TSP problems will be an effort that is misdirected and inadequate to eliminate the adverse health affects presently being experienced due to airborne particulate matter.

The third area of particular concern to Vermont is the prevention of significant deterioration section of the current (August 1977 amendments) version of the Act.

The intent of the Clean Air Act (CAA) on the Prevention of Significant Deterioration of air quality (PSD) are basic and sound ideas, those of

- . Keeping areas with clean air clean
- . Considering air quality impacts in future growth decisions, and
- . Providing special protection for pristine areas of national value

These concepts are not only appropriate to Vermont, but are essential to protect the character of Vermont.

Although unqualified support is provided to the concept of PSD, the statute as embodied in the CAA is in need of specific language changes to clarify the intent of Congress. This dramatic conflict between congressional intent and statutory language is evidenced by the decision of the U.S. Court of Appeals in Alabama Power vs. Costle.

Four possible solutions which would preserve and clarify the original intent of the PSD section include:

1) Amend the CAA with specific statutory language to make the PSD program an administrative program applicable to any new source of air pollution of 50 tons per year or more.

2) Enhance the concept that all new sources of air pollution must be designed with the best pollution abatement technology.

3) Retain the use of atmospheric diffusion models, but only as needed to support an administrative program.

4) Retain the present classification approach to clean air area management.

Approaching PSD as an administrative function would avoid a complex technical program to achieve the basic goal. Through a simplified program, Air Pollution Control Agencies could focus more on a product than on a process. Thereby, simplifying programs and eliminating uncertainty and delay in industrial planning and siting. Vermont in, developing its attainment and nonattainment plans, has merged the new source review requirements called out for in Part C and D of the present Act. This unified new source review permit program has now operated for over two years. Based on the experience, permits for major sources have been issued in 65 days (average) and in 18 days (average) for minor sources.

As indicated by the National Academy of Science in its report on PSD, and consistent with Vermont's experience, the emphasis of a PSD program must be placed on the control of air pollution before its release, above all else. This must be the first stated objective of the program. A program which emphasis pollution control is environmentally sound, provides room for greater industrial and economic growth and, more importantly, recognizes that there is no real "safe" level of pollution. In providing for a comprehensive review of pollution control technology in the project's developmental stages ensures that the selected system is best for the proposed project, can be designed into its operation and assures that it will be completed when it can best be afforded, thereby keeping costs to a minimum at the time when they can best be afforded.

Implicit with preventing significant deterioration of air quality is an analysis of the effect which new emissions would have on present air quality and a determination of what constitutes an unacceptable deterioration of air quality. The present increments of deterioration attempts to accomplish this. However, the inclusion of increments for short averaging times (3-HR, 24-HR) and rare occurrences have made the analysis extremely complicated and taxed state-of-the-art air quality models to their limits.

Vermont supports retention of the classification of clean air areas, at the same time recommends that the deterioration limits be set for long averaging periods on a seasonal or annual basis. This time frame is most consistent with the notion of degradation.

The use of atmospheric dispersion models should be retained. They are a necessary and vital tool in evaluating future air quality impacts. However, their limitations are not recognized in the present act. Models are not absolute, performing best at indicating magnitude of change over long averaging periods (seasonal, annual).

The fourth and final area of concern to Vermont is the need to streamline the State Implementation Plan process. It was clearly the intent of the Clean Air Act that the prime responsibility of carrying out the provisions of the Act would rest with the states, through the State Implementation Plan (SIP). Over the years since the first SIP submittals in 1972, Federal regulations seem to increasingly complicate the relationship between the states and the Federal government in this process. When the Air Pollution Control Program for the State of Vermont developed and submitted its first SIP in 1972, there is no question that it was a process of haste to meet the Congressional mandate. The effort was completed with the minimum amount of technical support data. The Air Pollution Control Program in this state has matured over the years. It has a fine technical staff that has acquired quality data on air quality throughout the state. But to make changes in the SIP, even to correct the informational base that original decisions were made on is a difficult task through the SIP process. Attached are the chronologies of the SIP submittals by the state to EPA. The first one dates back to 1975 regarding the sulfur content of fuels. The second one is an attempt by the state to change the air quality designation of Chittenden County. Let us review the sulfur in fuel SIP.

The SIP submitted in 1972 set a regulatory standard for one percent sulfur in fuel oil. The standard was developed based on the information available in the time alloted to develop our SIP. The standard was to be phased in over a three year period. By the time that final regulation was to take effect, the unavailability of lower sulfur oil due to the Arab Oil Embargo was so severe that the final phase of the regulation was never implemented. In the time which has passed, more information was received from our monitoring stations. It was determined at these air monitoring stations that during the peak consumption of fossil fuels our monitoring stations would reach no more than ¼ of the federal standards on a 24-hour basis, but due to the high terrain features associated with Vermont and the conservative nature of predicted modeling, there were some instances when on a 24-hour basis under maximum production violation of standards were predicted. The probability of all of these events occurring at the same time would be rare indeed, but possible in the eyes of the EPA review process. EPA has chosen not to enforce these standards, and therefore the lack of federal action has not had an adverse effect in Vermont but nevertheless, it has let the possibility stand that these sources would be subject to citizen's suits under the Clean Air Act. This submittal, though longer than most, exemplifies some of the problems associated with getting any change to the State's Implementation Plan and causes confusion among the regulated community on what regulations apply.

The concept of the process should not be significantly changed, but the states need more discretion in implementation system. The State fully supports the position of both the State and Territorial Air Pollution Control Administrators as well as the National Governors' Association on the necessary changes to the Clean Air Act that deal with the issue of SIP's and allowing the State greater flexibility and discretion to operate state air pollution control programs within the context and requirements of the Federal Clean Air Act.

ATTACHMENTS AND REFERENCES

Due to the technical nature of the testimony on the long range transport of air pollutants, a list of references has been included for this section. For the most part these references are secondary in nature, in that they refer to summary type documents and memorandums. Where possible these reference works are included as attachments.

Also attached is a chronology of sulfur dioxide and oxidant redesignation submittals to U.S. EPA as referenced in the section on the state implementation plan process.

In addition, several attachments are included which are not directly referenced in the main body of testimony, but are considered to be pertinent to the testimony. These additional attachments include:

> "A Report on the Effects of Acid Precipitation on Several Vermont Lakes", 1980, "Vermont Acid Precipitation Lake Monitoring Program, 1980, both prepared by Brian Kooiker of the Water Quality Division of the Vermont Department of Water Resources and Environmental Engineering, (The attached and referenced memorandum from W. McLean to D. Clough provides a summary of these two reports), The June 1981 issue of "Land and Air", a quarterly report from the Vermont Agency of Environmental Conservation, Air and Solid Waste Programs, which provides additional information on the transport and fine particulate issues, and an interagency memorandum from R. Poirot to W. McLean which provides additional information on sulfate transport into Vermont.

Due to the lengthy nature of these attachments, only one (1) copy has been submitted.

These additional attachments should be considered an integral part of this testimony. Those sources referenced directly are listed on the following page.

REFERENCES

1. Wilson, R. et. al., Health Effects of Fossil Fuel Burning: Assessment and Mitigation, Ballinger Publishing Co., Cambridge, Massachusetts, 1980, p. 90.

2. Perera, F. and A.K. Ahmed, Respirable Particles, Ballinger Publishing Co., Cambridge, Massachusetts, 1979, p. 10.

3. "Northeast Damage Report of the Long Range Transport of Air Pollutants", Northeast Regional Task Force on Atmospheric Deposition, April 1981, pp. 55-59.

4. Ibid, p. 46.

5. Ibid, pp. 40-43

6. Ibid, pp. 38, 39.

7. Ibid, p. 7.

8. "Study of the Role of Transport in Fine and Total Suspended Particulate Air Quality", Final Report, Prepared by Atmospheric and Environmental Research for the National Commission on Air Quality, February, 1981, p. I-51.

9. "Northeast Damage Report....", op. cit., p. 57.

10. Ibid, p. 47.

11. Interagency Memorandum from Wallace M. McLean to David L. Clough, regarding "Acid Precipitation - Its Occurrence and Impact on Aquatic Ecosystems in Vermont", June 19, 1981.

12. Ibid.

13. Ibid.

14. Ibid.

15. "The Potential for Coal Use and Related Economic and Air Quality Implications of Future Energy Scenarios", Final Report, Prepared by O.R.I. for The National Commission on Air Quality, March, 1981, pp. 2-30, 2-31.

16. "Northeast Damage Report....", op. cit., p. 38.

17. Vermont SIP November 1979, pp. 6-44, 6-44A.

CHRONOLOGIES REGARDING SULFUR DIOXIDE AND OXIDATION REDESIGNATION SUBMITTAL TO THE U.S. EPA

CHRONOLOGY OF SULFUR-IN-FUEL
SIP DEVELOPMENT
SIGNIFICANT EPA/STATE CONTACTS
(AUGMENTED WITH INFO FROM EPA'S FILES)

Sometime in 1974	Federal Energy Office (FEO) promulgates regulations under which sources 50 Million BTU/hr heat input must use fuel with sulfur content at least as high as burned in November 1973.
6/21/74	A letter from Regional Counsel Bracken to Valentinetti explaining the FEO policy on sulfur in fuel and requesting Vermont to submit names of affected facilities.
7/12/74	A letter from Valentinetti to Devine indicating that contrary to what Dick had originally thought (in some other communications), the Emergency Sulfur Regs were not yet submitted, but would be within a week.
*7/18/74	Submittal of Emergency Sulfur in Fuel Regs as a SIP revision.
8/8/74	A letter from Devine to Martin Johnson confirms receipt of SIP revision for Sulfur in Fuel dated 7/18/74.
3/5/75	Apparently some problems with revision? But in any case a second submittal of Sulfur in Fuel revisions is made.
9/26/75	A letter from Hennessey to Barboza requesting data so as to be able to model the SO_2 impacts of the Sulfur in Fuel revision.
o*11/17/75	SIP returned Hohman to Johnson (formally and physically).
5/4/76	A letter from Hohman to Johnson outlines the modeling to be done and refers to a promise by Valentinetti to give all data by 6/30/76. Procedural requirements would have to be followed; infers resubmittal necessary.
o*7/12/76	Thank you for submittal (all data requested 5/4/76) Hohman to Johnson.
9/76	Analysis of Sulfur in Fuel SIP revision begun by Hennessey.
o*12/2/76	From RAV to Hohman "pending revision".
12/22/76	A letter from Hohman to Valentinetti indicating why Sulfur in Fuel revision SO_2 modeling is proceding slowly. Predicts that technical analysis will be completed by 2/28/77.
o*5/10/77	A letter from Valentinetti to Hohman requesting a draft report from Hennessey. Cites original submittal date 5/4/74.
o*7/19/77	A letter from Valentinetti to Hohman requesting information on what is happening with the Sulfur in Fuel revision. "All material has been submitted".
11/10/77	A chart attached to a routing transmittal slip is sent from Hennessey to Cambio as a response to a request by Cambio for a draft or summary of modeling results of the Sulfur in Fuel SIP revision analysis.

8/29/78	A letter from Valentinetti to Adams requesting clarification of where the Sulfur in Fuel revision is in the EPA analysis process.
9/8/78	A letter from Hohman to Valentinetti indicating that EPA would send the State the Sulfur in Fuel analysis by 9/30/78.
o*9/29/78	Devine to Valentinetti:AEC must resubmit submissions.
--- Apparently	the Sulfur in Fuel SIP revision analysis did arrive by 9/30/78.---
2/16/79	A letter from Blanchet to Hennessey in response to the analysis sent up in September 1978. In this letter (lengthy), the concerns about the modeled impacts of several facilities were addressed.
5/11/79	A letter from Hennessey to Blanchet responding to the 2/16/79 letter and indicating that Hennessey was not entirely convinced by the counter analysis on the several facilities. Hennessey also indicated that EPA could do no more modeling at this time.
11/6/79	A letter and complete technical analysis was sent down from Valentinetti to Ciavatierri as a more formal response to the Sulfur in Fuel SIP revision analysis done by EPA. Three facilities were not dealt with but the letter stated they would be dealt with later. In addition to these three, the Moran Generating Station was excluded as it was to be dealt with separately. Referred to "pending revision".
10/14/80	RAV to Laing taking issue with status of SO_2 SIP revision.
12/17/80	Laing to RAV responding to 10/14/80 letter. Revision now pending also accepting 11/6/79 analysis and concurring in four sources needing additional documentation. Recent changes in PSD rules indicate this revision will not consume increment.

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o Not in State files

* Significant correspondence

State of Vermont

AGENCY OF ENVIRONMENTAL CONSERVATION

Montpelier, Vermont 05602
OFFICE OF THE SECRETARY

Department of Fish and Game
Department of Forests, Parks, and Recreation
Department of Water Resources
Environmental Board
Division of Environmental Engineering
Division of Environmental Protection
Natural Resources Conservation Council

August 13, 1980

William Adams, Jr.
Regional Administrator
U.S. Environmental Protection Agency
Region I
John F. Kennedy Federal Building
Boston, Massachusetts 02203

Dear Mr. Adams: / Bill

The deadlines and pressure to submit state implementation plans (SIP's) in accordance with the amended Clean Air Act have essentially passed, at least in Vermont. However, if the plans are to be the dynamic entities envisioned by Congress to attain and maintain the desired level of air quality, the SIP revision process must be revamped and made responsive to the needs of both the State agencies and EPA.

The attached chronology spans over 2½ years and details the effort of the State to obtain a simple SIP revision - redesignating Chittenden County Vermont from nonattainment to unclassifiable. This request had been discussed and supposedly been agreed to prior to its submission (including discussing in the Federal Register). The nonattainment designation was in error to begin with since two violations, although occurring on two different days, were in reality the same air pollution episode eg. commencing at 11:00 p.m. on the first day and ending at 2:00 a.m. on the second day.

The intent of this letter is not to elicite your intervention on this specific issue, in fact our respective staff members are working toward a mutually acceptable agreement, but to identify a problem symptomatic to the SIP process in hopes that change can be effected.

Sincerely,

Brendan J. Whittaker

Brendan J. Whittaker
Secretary, Agency of
Environmental Conservation

Attachment

CHRONOLOGY

December 5, 1977 (letter): Martin Johnson to William Adams, Jr., transmittal of air quality designations per Section 107 of the amended Clean Air Act. AQCR 159 & 221 (entire state) designated as not meeting AQS.

May 6, 1978 (letter): Richard Valentinetti to Tom Devine, request for designation be revised to Chittenden, Franklin and Windsor counties to nonattainment, the remainder of the State attainment.

: EPA response to May 6, 1978 letter that the Air Pollution Control Officer was not a high enough official to make such a request.

June 2, 1978 (letter): Reginald LaRosa to William Adams Jr., request for redesignation by acting agency secretary. Original designation based on consistency, redesignation based on monitored air quality. Chittenden and Windsor counties nonattainment, remainder of State unclassifiable.

October 25, 1978 (letter): Merrill Hohman to Brendan Whittaker, responding to redesignation request, however, response is based on data contained in the May 6, 1978 transmittal which was not acceptable. Will not publish redesignation as separate rulemaking incorporate in '79 SIP revisions.

December 29. 1978 (meeting): Richard Valentinetti and Don White. The error of designating Franklin county nonattainment best corrected through the '79 SIP revision process.

February 8, 1979: Final rulemaking amending the NAAQS of 0.08 ppm O_x to 0.12 ppm O_3.

February 12, 1979 (telecon): Richard Valentinetti and Frank Ciavattierri, discussed the confusion surrounding the oxidant designations of Vermont areas.

February 20. 1979 (letter): Richard Valentinetti to Frank Ciavattierri summary of conversation of February 12th - correcting the confusion which existed.

August 7, 1979 (letter and report): Richard Valentinetti to Frank Ciavatterri, evaluation of Vermont O3 data in comparison of revised standard, supports AEC request for Chittenden County to be designated attainment.

September 18, 1979 (letter): Merrill Hohman to Richard Valentinetti. EPA concurs with findings of August 7. 1979 transmittal, however, cannot concur with redesignation request. Raises issues of instrument siting. Proposes to approved redesignation to unclassifiable, conditioned to instrument relocation and special study. Requests formal submittal of redesignation request.

December 11, 1979 (letter): Brendan Whittaker to William Adams, Jr., formal request for redesignation of Chittenden county to unclassifiable and subsequent removal of VOC regulations. Commits to monitor relocation.

February 19, 1980 (F.R. Notice): Federal Register notice, final rulemaking Vermont SIP page 10778 ..."EPA has agreed that should approval to redesignate Chittenden County to unclassifiable be approved, the VOC regulations currently required of sources in that county would not be required for the attainment plan and could be withdrawn from the federally approved SIP."

Various Dates: Several staff level communications regarding redesignation request.

June 17, 1980 (letter): Richard Valentinetti to Peter Haggerty, response to request for administrative support documentation for redesignation and regulation removal-same as that transmitted to EPA in November, 1979.

June 24, 1980 (letter): Merrill Hohman to Richard Valentinetti, must amend State regulations before EPA could process redesignation of Chittenden County.

NORTHEAST STATES FOR COORDINATED AIR USE MANAGEMENT
(NESCAUM)

MEMBERS:
CONNECTICUT AIR COMPLIANCE UNIT
MAINE BUREAU OF AIR QUALITY CONTROL
MASSACHUSETTS DIVISION OF AIR QUALITY CONTROL
NEW HAMPSHIRE AIR RESOURCES AGENCY
NEW JERSEY BUREAU OF AIR POLLUTION CONTROL
NEW YORK DIVISION OF AIR RESOURCES
RHODE ISLAND DIVISION OF AIR RESOURCES
VERMONT AIR & SOLID WASTE PROGRAM

Statement on the Economic Impacts of Acid Deposition

June 30, 1981

Mr. Chairman and members of the Committee, my name is F. Peter Fairchild, I am Executive Director of The Northeast States for Coordinated Air Use Management (NESCAUM) which is an organization of the state air pollution control agency directors from Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York and New Jersey. Our members are committed to the solution of regional air pollution problems through cooperation and exchange of technical information.

From our perspective, acid rain is only one more convincing example of a problem we have been trying to deal with for many years, namely the long range transport of air pollutants. These transported pollutants interferes and in some cases prevents us from meeting air quality standards that we are bound by law to meet. They endanger public health and damage the environment, yet we have no control of their source.

Because of our concern over the problem of long range transport and acid rain, NESCAUM along with our counterparts in state water pollution control agencies (The New England Interstate Water Pollution Control Commission) have established a Northeast Regional Task Force on Acid Deposition. The task force has prepared a Damage Assessment Report (which is attached) and a slide/tape presentation of documenting the environmental and health damages related to acid preception.

The New England River Basins Commission as part of the Task Force agreed to attempt to define costs associated with the damages we reported. NERBC convened a meeting of regional and national experts on economics and acid deposition and the results of this working group meeting plus the additional NERBC staff analysis were presented in the attached report entitled "The Economic/Social Significance of Acid Deposition in the New England/New York Region".

The key findings of the report are as follows:

1. Overall estimate of damage costs in New England and New York for aquatic and terrestrial ecosystems and materials was $250 to $500 million per year in 1980 dollars.
2. This is further broken down into losses to recreational fishing and related tourism ($20-50 million); drinking water supply treatment ($1 million); lumber, paper, and related industries, assuming between a 1% and 5% loss in productivity ($80 to $400 million); crops and other vegitation losses ($1 million); and man made materials ($100 to $200 million).
3. These estimates are conservative for the following reasons:
    a. They are based on currently known damages attributable to acid deposition.
    b. They do not consider the many vulnerable areas that will experience damages in the near future if acid rain deposition is not abated.
    c. They do not consider the many secondary economic costs that are difficult to quantify but that do occur with the loss of a valuable natural resource.
    d. They do not include any estimates of the health effects related to drinking water or fish contamination or to direct inhalation of fine particulates.
4. If these other considerations are included, the Work Group concluded that the damages to the New England-New York region may be as much as $2.5 billion per year.

Like all the evidence we have collected to date, this survey of economic costs related to acid deposition supports our contention that long range transport of air pollutants must be reduced. While admittedly these are controversies over exactly how and how much we should control the pollutants that cause acid rain, we must not let these arguments prevent us from achieving the primary objective which is to provide a clear legal mandate in the Clean Air Act to deal with the problems of long range pollution transport.

NORTHEAST STATES FOR COORDINATED AIR USE MANAGEMENT
(NESCAUM)

MEMBERS:
CONNECTICUT AIR COMPLIANCE UNIT
MAINE BUREAU OF AIR QUALITY CONTROL
MASSACHUSETTS DIVISION OF AIR QUALITY CONTROL
NEW HAMPSHIRE AIR RESOURCES AGENCY
NEW JERSEY BUREAU OF AIR POLLUTION CONTROL
NEW YORK DIVISION OF AIR RESOURCES
RHODE ISLAND DIVISION OF AIR RESOURCES
VERMONT AIR & SOLID WASTE PROGRAM

Statement on Long Range Transport and Acid Deposition

June 30, 1981

Introduction

NESCAUM is an association of state air pollution control agency Directors from the six New England states plus New York and New Jersey. It was established in 1968 under the auspices of the New England Governors Conference as the official Regional Air Quality Planning Organization for the Northeast. Our members are committed to the solution of regional air pollution problems through cooperation and exchange of technical information. We are particularly concerned about the problems associated with the transport and deposition of acid pollutants, and we submit this statement as a means of developing effective solutions to these problems.

The Need to Deal With Long Range Transport

From our perspective, acid rain is only one more convincing example of a problem we have been trying to deal with for many years, namely the long range transport of air pollutants (LRTAP). The prevailing meteorology of the Northeast causes pollutants from the west and south of our states to be carreid into the region and also into southern Canada.

Long range transport effects a variety of pollutants. For example, sulfur and nitrogen oxides are emitted from relatively tall smokestacks and in extremely large quantities in the Midwest, particularly in the Ohio River Basin. These pollutants travel northeastward, being converted to sulfates and nitrates and then into acids in the atmosphere. Sulfates, nitrates, and other acid compounds are deposited by wet and dry processes in our region where they are causing considerable environmental

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damage. In addition, emissions of hydrocarbons from industry and motor vehicles are converted to ozone which is transported great distances. The transport of ozone into the Northeast causes repeated violations of the national air quality standard set to protect public health, and the exceedance of standards means that our states must apply stricter controls on local sources of hydrocarbons. Transported sulfates and other pollutants in fine particle form are also a problem. They interfere with our ability to meet or maintain air quality standards for particulates and they are also a direct health hazard.

These air quality problems are serious ones. Long range transport of air pollutants is undermining our efforts to keep the air clean and to protect the public health. Also, it creates significant economic, institutional, and equity difficulties for the Northeast, yet the sources of the problem are beyond our jusisdiction. Unfortunately current Federal regulations and the Clean Air Act do not make it clear just exactly who does have the jurisdiction. Since this is a regional pollution problem, we look to EPA as the appropriate agency to resolve the issue, but EPA has failed to take action under the several sections of the Act that might be used to control LRT. Furthermore, they have exacerbated the problem by their inconsistent handling of state air quality control plans for SO_2 and hydrocarbons in different EPA Regions, and their delays in setting fine particulate and/or sulfate air quality standards. Section 126 of the Act allows a state to challenge a decision if it creates an interstate pollution problem, but this is a piecemeal approach to a problem that demands a coordinated regional or national control strategy.

Suggestions for Dealing With LRTAP

We expect there to be considerable debate and exchange of viewpoints regarding acid rain during the CAA re-authorization process this year. We urge that whatever controversy over specific strategies for controlling acid rain there is, it does not obscure the absolute necessity for dealing with the broader question of long range transport. We urge Congress to amend the Act to provide the authority and specific direction for regulating transported air pollutants. This mandate should call for action in dealing with all transported air pollutants, not only criteria pollutants. A suggested framework for this authority must involve the designation of regional air pollution transport areas, involving all source and receptor states for each appropriate pollutant. Sections 107 and 110 of the CCA should be amended to require designation of the multi-state transport areas within 9 months of the request for designation by a Governor, and development by EPA of necessary emission control strategies within 2 years of the area designation. Interstate agreements on emission reductions consistent with this schedule shall take precedance over the Federal Program and shall be enforceable by the EPA.

This approach recognizes that states have the primary responsibility for implementing air pollution control regulations, and they should be given the opportunity to develop interstate agreements to reduce LRTAP. It also recognizes the difficulty in this process, and provides a mandate to EPA for action as well. Whatever CAA amendment is finally adopted on this issue should include the basic elements outlined above.

The Specific Issue of Acid Deposition

While we indicated that acid rain is really another long range transport problem and should be handled as such, this is not to say that we are not concerned with the unique effects of acid deposition that includes both acid precipitation and dry deposition. NESCAUM and the New England Interstate Water Pollution Control Commission have established a Regional Acid Deposition Task Force made up of state air and water agency staff from the Northeast states. This Task Force has collected and reviewed available data on acid deposition in our region and has published a Damage Assessment Report. They have also prepared a slide/tape presentation to describe the environmental impacts of acid percipitation, and they must have requested the New England River

Basin Commission to conduct an economic analysis of the potential losses attributable to acid deposition.

In brief, these materials show that long range transport is bringing acid pollutants into our region and that these pollutants are being deposited on water and land surfaces. Serious aquatic damages have been documented as well as effects on soils, vegetation, forests, materials, and visibility. Significant potential health effects were also noted, and the costs of damages (not including health costs) were estimated to be in excess of $250 million and may be as large as $2.5 billion per year in New England alone. We think the evidence is more than sufficient to justify immediate action to reduce the causes of acid deposition. The already high and increasing SO_2 and NO_x emissions in the Midwest cannot continue without continuing the significant impacts on the Northeast.

NESCAUM believes that steps must be taken to reduce the atmospheric loadings of acid deposition precursors as soon as possible. We favor the establishment of a national or a regional emissions ceiling that would result in an actual reduction of SO_2 and NO_x emissions that are subject to long range transport. Coal washing is a cost effective control strategy and should be mandated immediately for coals that can benefit from this process. Also, the low NOx burner design being developed by EPA promises to be extremely cost effective; development and retrofitting of this equipment should be expedited. EPA has published hundreds of pages of documentation for a fine particulate standard, and this standard should be proposed not later than January 1, 1982. Furthermore, it has been over 5 years since EPA decided that a sulfate standard could not be established at that time. This decision should be reconsidered in light of the considerable health data developed in the interim. These actions should be required as the basis for a regional control strategy for acid deposition. They represent a reasonable first step to reduce emissions in the most practical way. We expect that additional actions may be necessary in the future as research currently in progress becomes available. We specifically have not suggested a particular mechanism for acheiving the regional emissions limit but there are many potential strategies being discussed. We expect the debate to clarify the strengths and limitations of the various options and that reasonable and equitable strategies will be developed.

In closing, NESCAUM will continue to work cooperatively within the Northeast for practical and effective solutions to regional air quality problems. In most cases, we support providing states with increased latitide and authority in regulation of pollution sources; however, we believe that the problem of long range transport will not be solved without a strong Federal presence. That presence does not exist at present, and the key to establishing it lies with the Congress. We urge consideration of our recommendations and establishment of the mandate to deal with this issue.

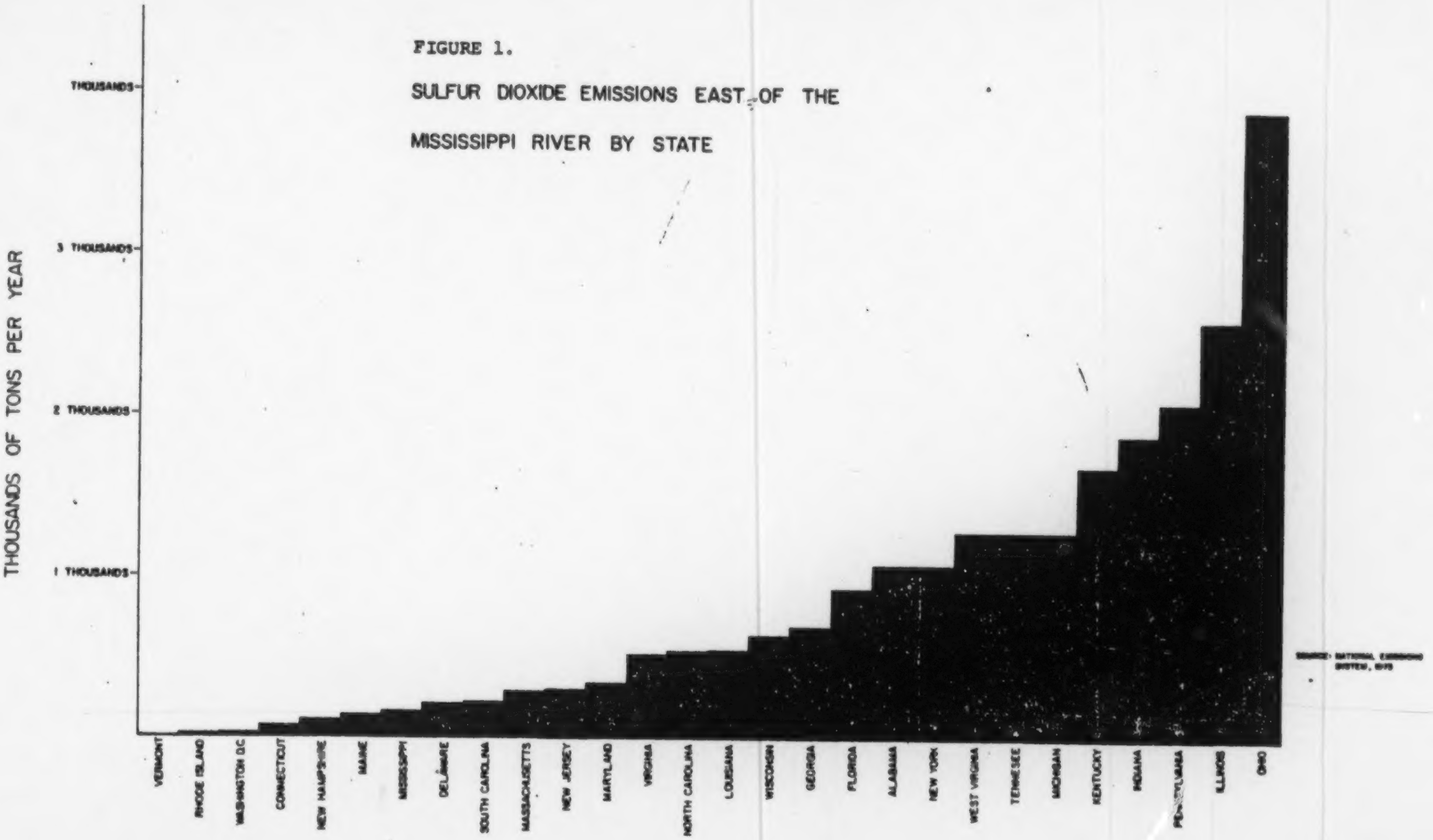

FIGURE 1.

SULFUR DIOXIDE EMISSIONS EAST OF THE MISSISSIPPI RIVER BY STATE

SOURCE: NATIONAL EMISSIONS [illegible]
SYSTEM, [illegible]

NON-URBAN AREA SO_2 EMISSION LIMITATIONS FOR COAL FIRED POWER PLANTS

STATE	PLANT	EMISSION LIMITATION POUNDS SO_2 PER MMBTU	%S
OHIO	CARDINAL	4.76	3.1
	MIAMI FORT	5.5	3.6
	ASHTABULA	9.1	5.9
	AVON LAKE	6.1[1]	4.0
	EASTLAKE	6.6[1]	4.3
	STUART	3.16	2.1
	CONESVILLE	5.66	3.7
	TORONTO	8.1	5.3
	PICWAY	6.04	4.0
	SAMMIS	4.5	3.0
	GAVIN	9.5	6.3
	MUSKINGUM	6.48	4.3
	KYGER	8.2	5.4
WEST VIRGINIA	MITCHELL	7.5	4.7
	HARRISON	5.1	3.4
	KAMMER	6.8[2]	4.5
INDIANA	GENERAL LIMITATION	6.0[3]	4.0
ILLINOIS	GENERAL LIMITATION	6.0[3]	4.0
PENNSYLVANIA	GENERAL LIMITATION	3.7[4]	2.4
NEW ENGLAND	MAX (6-STATES)	4.0	2.5
	AVERAGE (6 STATES)	2.1	1.4

[1] RECENTLY PROPOSED FEDERAL LIMITATION

[2] STATE LIMITATION

[3] VARIANCE ALLOWED FOR INDIVIDUAL PLANTS. CURRENT MAXIMUM LIMITATION FOR ILLINOIS IS 10.0

[4] EXCURSIONS UP TO 4.8 ARE ALLOWED FOR TWO DAYS OUT OF EACH THIRTY-DAY PERIOD, 30-DAY AVERAGE - 3.7, 24-HOUR AVERAGE - 4.0

NORTHEAST DAMAGE REPORT

Of The

LONG RANGE TRANSPORT & DEPOSITION OF AIR POLLUTANTS

APRIL 1981

PREPARED FOR

Northeast States for Coordinated Air Use Management (NESCAUM)

and the.

New England Interstate Water Pollution Control Commission (NEIWPCC)

BY

Jennie E. Bridge, NEIWPCC, 607 Boylston St., Boston, MA 02116

F. Peter Fairchild, NESCAUM, Boston College Observatory, Weston, MA 02193

NORTHEAST REGIONAL TASK FORCE ON ATMOSPHERIC DEPOSITION

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Members and Affiliates

CONNECTICUT

Phil Florkowski	DEP - Air
Charles Fredette	DEP - Water

MAINE

David Tudor	DEP - Air
Matthew Scott	DEP - Water

MASSACHUSETTS

Kenneth Hagg	DEQE/DAQC
Alan VanArsdale	DEQE
Al Ferullo	MDC
Susan Brand	Dept.of Atty.Gen.

NEW HAMPSHIRE

Tom Noel	Air Res.
Ronald Towne	WS&PCC

NEW JERSEY

Raoul Cordeaux	DEP - Air

NEW YORK

Peter Coffey	DEC - Air
Italo Carcich	DEC - Water
Scott Quinn	DEC - Water
Michael Surgan	Dept. of Law

RHODE ISLAND

Michael North	DEM - Air
Michael Annarummo	DEM - Water

VERMONT

Richard Poirot	AEC - Air
David Clough	AEC - Water

NEW ENGLAND WATER WORKS ASSN.

Floyd Taylor	Carlisle, MA

U.S. FISH & WILDLIFE SERVICE

Terry Haines	Orono, ME
Arnold Julin	Newton, MA

U.S.G.S.

John Briggs

EPA REGION I

Valentine Descamps	Air Div.
Bart Hague	Water Div.
Don Porteous	NERL

STAFF SUPPORT

Jennie Bridge	NEIWPCC
Peter Fairchild	NESCAUM
William Febiger	NERBC

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INTRODUCTION

The following report has been prepared with the help of various members of the Northeast Task Force on Atmospheric Deposition. Members of the Task Force include state air and water pollution control agency staff appointed by the agency directors, as well as affiliate members from other state and federal agencies. The Task Force was formed at the request of NESCAUM and NEIWPCC to address the impacts of atmospheric deposition in the Northeast, control strategy alternatives, and future research needs.

This report is the response of the first objective assigned the Task Force: assessing the regional impacts of atmospheric deposition. Before the actual damage section of the report, the long range transport phenomenon is discussed, including information on regional differences in pollution emissions, atmospheric transport studies, and the use of regional transport models. Air and precipitation monitoring in this part of the country is also discussed. Finally, the regional impacts of atmospheric deposition are presented, covering the general extent of regional vulnerability, damage to terrestrial and aquatic ecosystems, material, visibility, and human health and welfare.

Although the damage section is divided into six different subsections, it must be emphasized that these are artificial divisions, used only for organizing a great deal of material. The impacts of long range transport and atmospheric deposition are interrelated among the categories, and have complex and far reaching consequences.

Material in the report has been organized in the following manner: Each section has a general introduction, and explanations of various points to be made clear and background information are stated in general terms. Specific regional documentation is presented in subsequent starred (*) and referenced paragraphs. A brief summary statement is also provided at the end of each section.

The following report presents evidence available, as of March 1981, of damage in the northeastern United States that is attributed to the long range transport and deposition of air pollutants. Some of the information was abstracted from published reports. However, since much of the research in this field is ongoing, information was also taken from unpublished material, letters, and personal interviews with researchers or state and federal resource agency staff.

Evidence presented in this report has been selectively chosen to support the joint concern of the region's state air and water pollution control agency directors over the adverse impacts of the long range transport of air pollutants in this specific area: the Northeast States of Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont. The report is neither an exhaustive review of all literature available on the subject, nor a complete presentation of the more controversial issues involved. General attempts at the former are available elsewhere (Cowling, 1980; Altshuller and McBean, 1980; Bubenick et al., 1980; Wisconsin Dept. of Natural Resources, 1980); comments and rebuttals to controversial issues will be covered in separate position papers. Furthermore, the focus on the Northeast region of the United States has precluded any attempt at addressing the equally, of not more severe, damage suffered by the region's neighboring country of Canada. In summary, the purpose of this report is to present as much documented evidence of damage as possible, to serve as an explanation of the regional concern over the problem of long range transport and atmospheric deposition, and to serve as a basis for the region's support for and sense of urgency concerning essential national control strategies.

DEPOSITION AND LONG RANGE TRANSPORT OF AIR POLLUTANTS

The physical and chemical processes of the atmosphere that relate to acid precipitation are exceedingly complex and any detailed discussion is beyond the scope of this report. However, it is necessary to review these processes at least in a general way to understand the unique nature of the northeastern United States as a receptor region for long range transport and deposition of pollutants. Also it is important to establish at the outset the terminology that will be used in this report.

ATMOSPHERIC DEPOSITION PROCESSES

The term acid rain is only one aspect of the complicated physical and chemical processes of our atmosphere. This section describes the processes that are at work on pollutants emitted into the atmosphere, and that eventually result in the removal of these pollutants to the earth's surface.

Pollutants are emitted to the atmosphere and can exist there as gases, liquids and vapors, and particles. Removal of these pollutants occurs through a variety of mechanisms including: condensation of moisture on extremely small nuclei in clouds to form rain drops (rainout); dissolution and chemical change of pollutants in these cloud droplets as they grow and eventually fall to the ground in precipitation (droplet growth); scavenging of pollutants below the clouds by falling precipitation (washout); settling due to gravity of large particles (sedimentation); coagulation and collision of small particles with larger particles (accumulation); physical removal of small particles on ground surfaces and obstacles due to air motions (impaction); and adsorption and absorption of gases on the ground surface (sorption). The first three processes (rainout, droplet growth, and washout) are referred to collectively as wet deposition processes. The other processes (sedimentation, accumulation, impaction and sorption) are referred to as dry deposition processes. All deposition processes combined are referred to as atmospheric deposition. The atmospheric deposition of acidic compounds, as discussed below, is referred to as acid deposition.

Sulfur dioxide (SO_2) and nitrogen oxides (NO_x) are important air pollutants and are also the dominant precursors to acid deposition. SO_2 is soluble in water and can be removed directly by washout if a precipitation event occurs near the source of the emission. (NO_x is not readily soluble and direct removal is limited.) Most of the SO_2 and NO_x disperses in the atmosphere, and is converted to various sulfate and nitrate compounds. These compounds are initially the extremely fine particles which serve as condensation nuclei for rain and snow formation. In the presence of moisture, sulfates and nitrates form sulfuric and nitric acids, and they become the major component of acid precipitation, accounting for over 90% of the acidity in rain and snow samples (Altshuller and McBean, 1980).

Until recently, wet deposition of sulfates and nitrates was considered the chief mechanism by which acidic substances are removed from the atmosphere. In the last few years, consideration of more extensive observations, regional modelling results, and mass balance calculations has led to the conclusion that dry deposition processes are probably of equal importance (GCA, 1980).

While attention has focused on sulfate and nitrate related acid precipitation, this is only one manifestation of atmospheric transport deposition. The same processes that create acid rain are also causing the wet and dry deposition of other acids, and a variety of harmful metals and organics. Other acid compounds of interest include the transformation products of other gaseous emissions, some aerosols, and particulate matter. There are also materials in both wet and dry deposition that are not acidic but are potentially injurious to human health as well as to plants, animals and materials. These include ammonium ion, carbon, organics, and trace metals associated with industrial processes such as Zn, Cu, Fe, Al, Pb, Cd, Vn, Hg, As and Ni.

Another important aspect of atmospheric transport deposition is the particle size of air pollutants. While coarse particles (those greater than 2.5 micrometers [µ] in diameter) settle from the atmosphere in a matter of hours, fine particles (those less than 2.5 µ in diameter) can stay suspended for days where they can be washed out or removed by dry deposition. 90% of sulfates, and the majority of nitrates, polynuclear aromatic matter, as well as metals such as As, Cd, Zn, and Pb, occur as "fine" particulates in the atmosphere. They serve as condensation nuclei for droplet formation and are an integral part of the chemistry of precipitation. Because of the long residence time, fine particles can be transported by air mass movement for long distances. In fact, up to 70 to 90% of sulfate aerosols can be transported across regional boundaries (Ozkaynak et al., 1981). In addition to their close association with the process of atmospheric transport and deposition, fine particles are a health concern because they are easily inhaled deep into the lungs.

Summary

Because of their size, chemical nature, and prevalence, sulfate and nitrate compounds are an integral part of atmospheric chemistry and are the main cause of acid deposition. Atmospheric deposition also includes other extremely harmful compounds, primarily organics and metals. Finally, sulfates, nitrates and these other components of atmospheric deposition are subject to long range transport because of their existence as fine particles.

EMISSIONS

At the present time in the Northeast, SO_2 is responsible for about 60% of the acidity in precipitation and nitrogen oxides are responsible for about 30%. SO_2 is mainly a product of power generation, while about 1/2 the NO_x emissions come from transportation sources and the other half from power generation and other combustion sources. In the future, SO_2 emissions are expected to increase gradually; while NO_x emissions should increase significantly (Altshuller and McBean, 1980).

While there are both natural and manmade sources of sulfur and nitrogen oxides, it is the relatively large upwind emissions from industry and power plants in the Midwest that are the major concern for the Northeast.

- While natural SO_x emissions are significant on a global scale, they account for only 4 to 10% of the emissions in eastern North America (GCA, 1980).
- Manmade emissions of SO_2 and sulfate are four times the natural emissions in the northeastern United States (EPA, 1981).
- 1977 sulfur emissions data for states east of the Mississippi are shown in Table 1 and graphically in Figure 1 (English, 1979). New England emissions total $.67 \times .10^6$ tons/year, New York is 1.1 TPY and New Jersey is .32 TPY. Emissions from Ohio alone are almost twice the Northeast total. Taken as a region, Ohio, Illinois, Indiana, Kentucky and West Virginia produce 5½ times the sulfur emissions of the Northeast.

Summary

The primary precursor pollutant to acid deposition, sulfur dioxide, is emitted in significantly larger amounts by midwestern states compared to the northeastern states.

TABLE 1. 1975 State SO_2 Emissions (million tons/year)

State	Emissions 1975
ME	0.149
NH	0.118
VT	0.002
MA	0.305
RI	0.020
CT	0.078
NY	1.103
NJ	0.315
PA	2.135
DE	0.225
MD	0.354
VA	0.535
WV	1.259
NC	0.567
SC	0.238
GA	0.709
FL	0.948
OH	3.876
IN	1.945
IL	2.842
MI	1.332
WI	0.660
MN	0.311
IA	0.342
MO	1.271
KY	1.658
TN	1.284
AL	1.067
MS	0.174
AR	0.114
LA	0.567

Source: National Emissions Data System 1975

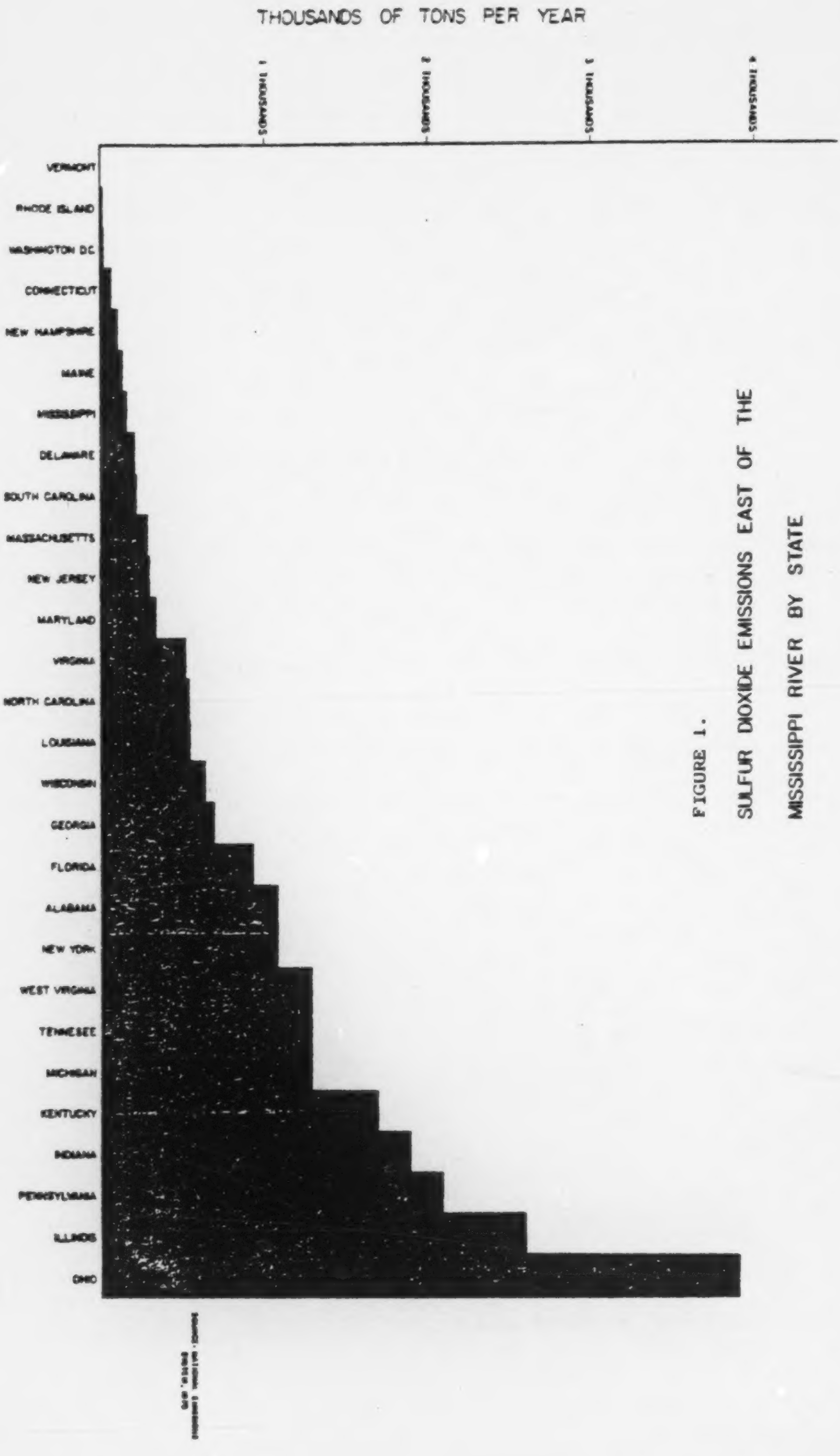


FIGURE 1.

SULFUR DIOXIDE EMISSIONS EAST OF THE MISSISSIPPI RIVER BY STATE

LONG RANGE TRANSPORT

Early studies on the phenomenon of long range transport of air pollutants were conducted in Europe in the late 1960's and early 1970's where concern over the effects of acid precipitation in Scandinavia was growing. A major multinational study of the problem was launched in 1972 by the Organization for Economic Cooperation and Development (OECD). The final OECD report was released in 1977 and it concluded that long range transport did occur, and that any one European country is measurably affected by emissions from other European countries. Interest and concern for acid rain was increasing in the United States during the early 1970's, spurred by the public attention to the work of Likens and his colleagues. Many individual efforts, and regional studies like the Multi-State Atmospheric Power Production Pollution Study (MAP3S), Sulfate Regional Experiment (SURE), and the Ohio River Basin Energy Study (ORBES) have been initiated in this country to investigate the emission, transport, and deposition of sulfur and nitrogen compounds.

Transport Conditions in the Northeastern U.S.

One of the major conclusions that these and other U.S. efforts support is that the meteorological regime of the eastern United States is particularly conducive to long range transport and deposition of pollutants. The U.S. lies in the belt of the prevailing westerlies. The average flow across the country from west to east is impeded by mountain ranges and undergoes significant seasonal change.

- During the summer, air flow over the northeastern states is usually steady and strong from the southwest. When well established, this circulation transports acid rain precursor pollutants from the industrial regions of the Ohio Valley and other eastern states into the northeastern U.S. and Canada (GCA, 1980).
- Ample evidence has been accumulated to show that extended episodes of regional scale pollution occur over much of eastern North America (Altshuller and McBean, 1980).

- Particularly in the summer, slow moving or stagnant warm high pressure systems over the southeastern U.S. lead to enhanced flow of highly polluted air northeastward from the industrialized areas of the Ohio River Valley (GCA, 1980).

Not only do these episode patterns favor the buildup and transport of pollutants, they also favor acid deposition. These air masses are slow moving, moist, and they occur with predominantly clear skies. These conditions are ideal for sulfate formation. The weak motion of the winds makes ample opportunity for widespread dry deposition, while the periods of showers associated with these convective air masses and with the breakup of the stagnation pattern favor the washout of sulfates.

Transport Studies and Measurements

Detailed analyses of these high sulfate episodes have been performed by many researchers. Meteorological data for known episodes of high sulfate levels are readily available and analysis of air mass trajectories is relatively straight forward (Tong, et al., 1979; Ozkaynak, et al., 1981). As a result, the critical meteorological conditions for elevated pollutant concentrations are well known, and the regional patterns of pollution transport can be readily identified. Numerous studies of ground level deposition measurements and air mass movement support the conclusion that long range transport of acid deposition precursors is occurring in the Northeast (Oden, 1968; Husar and Patterson, 1980; Lyons, 1980).

- The most graphic proof of LRT is the work of Dr. Walter Lyons, of Mesomet Inc., who has prepared motion picture footage of "persistent elevated pollution episodes" which show the movement of sulfate "clouds" into the Northeast. Day to day satellite photographs show the same phenomenon (Lyons, 1980).

- Calculations of wet and dry deposition for the months of January and August 1977 were made using the EURMAP model. The results showed that only approximately one-quarter of the deposition that occurred in Region II (NY & NJ) originated there. One-quarter originated in Region III (PA, VA, WVA), while another quarter was transported from Region V (OH, IN, IL, MI, WI), a distance of between 500 and 1500 km. Other regions to the north and south accounted for the remaining quarter (Altshuller and McBean, 1980).

- Cogbill and Likens (1974) have studied the pH of precipitation and air mass trajectories in the Finger Lakes Region of central New York, and conclude that air masses containing precipitation with the lowest pH originate in the midwestern United States.

- Harr and Coffey (1975) suggest that additional acid input to the Adirondack Mountains, which are north of the area studied by Cogbill and Likens, may be the nickel smelting complex in Sudbury, Ontario, which contributes 10% of the anthropogenic sulfur dioxide emitted in North America.

- A 1975 study showed high sulfate levels simultaneously occurring at seven rural sites in New York and New Jersey (Lioy, et al., 1977).

- Air parcel trajectory analysis showed that high sulfate concentrations at three of these rural sites were associated with SO_2 emissions to the south and southwest of New York State. The highest concentrations of sulfate occur in air that first stagnates over the area surrounding the Ohio River Valley, and is then advected into New York as the high pressure system moves eastward (Galvin, et al., 1978).

- A report by Miller, et al., 1978 dealing with the origin of air masses producing acid precipitation at Ithaca, NY points to air trajectories from the southwest sector as being the source. These trajectories were high in sulfuric, nitric and hydrochloric acids.

- Average SO_4 in rainwater has been measured at a site in western Massachusetts and a site on the east coast. When the coastal data is adjusted for sea effects, the values are within 10% of each other for corresponding sampling periods. This indicates a uniform spread of SO_4 from west to east across the state in precipitation events (MA DEQE, 1980).

While most evidence of transport is based on studies of sulfates, research involving other pollutants supports the long range transport (LRT) theory.

- Scientists at the University of Maine, Orono, have studied remote high altitude lakes with undisturbed watersheds. Chemical analysis of sediment cores show increases in Pb and Zn commencing about 1900, indicating Pb and Zn loadings from atmospheric deposition (Norton, et al., 1981).

- Another study of remote lakes in northern New England showed elevated levels of Hg in fish samples. There is no evidence of Hg sources in the area or any deposits in the geology, suggesting Long Range Transport as the source of the Hg (Akielaszeb and Haines, 1981).

- Similar findings of pesticide residue in fish in northern remote lakes across New England give further evidence of transport (Haines, 1981).

Interference with Air Quality Standards

Transport of sulfates, nitrates, and other fine particles is occurring to such an extent that it is interfering with, and in some cases preventing, the Northeast States from complying with the Federal Clean Air Act. The Act has established primary and secondary ambient air quality standards for Total Suspended Particulates (TSP) which must be met by the states. TSP includes both fine and coarse particles collected on filters. The portion of TSP that is transported from outside a state is beyond its jurisdiction to control yet it is measured as part of the state's TSP levels in determining compliance.

- Atmospheric sulfate represents a significant portion of TSP. In the Northeast, it can be as much as 50% of the total loading (EPA, 1981).

  These data were confirmed by an expanded 1977 study of three rural sites in New York (Coffey, et al., 1979). On occasion sulfate accounted for over half of the TSP.

- In the Niagara Frontier of New York, analysis of a registered violation of the annual TSP standard in 1978 indicated that if the annual sulfate level was subtracted from total particulate, no violation would have occurred. Further analysis showed that 75% of the sulfate levels in the Niagara Frontier air quality control region originates from the west and southwest of the state border (Kolak, et al., 1979).

- Sampling along the western border of Pennsylvania has shown an average concentration of sulfate which was 21.5% of the annual TSP concentrations. Further study showed that on six days when the TSP standard was exceeded, long range transport was definitely confirmed and the sulfate value provided the additional increment that caused the violation. Pennsylvania's failure to attain national health and welfare standards is due in significant measure to the transport of air pollution from out of state sources (Teknekron, 1979).

- A comprehensive statistical analysis of air quality and meteorological data over a 5 year period in Connecticut was performed. The results showed that as much as 70% of atmospheric particulates of which 25% are sulfates and nitrates are attributable to sources outside the state. On certain days, these transported pollutants are believed to cause air quality that approaches or exceeds national standards (Bruckman, 1981).

Summary

The meteorological regime of the northeastern United States is particularly conducive to long range transport and deposition of pollutants emitted in the Ohio River Valley region. The maritime tropical air masses occurring in the summer bring high levels of sulfate into the Northeast. The transport of sulfate has been verified by a number of independent observations using well documented sulfate episode data. Evidence exists to show the transport of other fine particles and pollutants into the Northeast region. This transport of fine particulate is interfering with the states' ability to meet mandated air quality goals.

USE OF REGIONAL TRANSPORT MODELS

Assessment of the nature and effects of acid deposition involve complex atmospheric processes, large scale regions of study, and long term averages of pollution exposures. These complexities necessitate the use of methematical models to simplify the transport and deposition process. Recently a number of regional transport models have been developed to calculate seasonal and annual SO_2 and SO_4 deposition over the eastern U.S.

Unfortunately the complexity of the processes the models are attempting to simulate and simplify makes it difficult to evaluate their results effectively. Validation requires long term historic field data of such measurements as wet and dry deposition. Such data are not available. A long period of precipitation and deposition data are necessary so that seasonal and yearly variations in precipitation can be accounted for. As a result of these problems, there currently exist large differences among model results and no comprehensive comparison and validation study has yet been performed. Since these models will be used as part of the development and testing of various pollution control strategies for acid deposition, it is important to review whatever preliminary information as is available to compare the results of three widely used models.

Under EPA sponsorship, SRI International has adopted a 2-dimensional trajectory model for the calculation of SO_2 and SO_4 deposition in the U.S. This model, known as EURMAP-1, (Johnson, et al., 1978) was originally developed for use in Europe. In its U.S. application, the model predicted that, based on 1977 emissions data from EPA's National Emissions Data System and the Electric Power Research Institute's SURE emission inventory, 44% of New England's sulfur deposition is from New England sources. 18% is contributed by Canada and only 6% from the three midwestern states of Ohio, Illinois and Indiana.

These results can be compared to similar results from the Pacific Northwest Laboratory model (McNaughton, 1980) and the model used by Teknekron in the Ohio River Basin Energy Study (Fay and Rosenzweig, 1979). The PNL model estimates that the New England States create less than 12% of their own sulfur deposition while Ohio, Illinois and Indiana account for over 20% of it. The Fay model gives similar results for sulfur transported over intermediate distances (100 to 500 km). It predicts smaller contributions to local SO_4 levels from local sources and higher contributions from more distant sources than does the PNL model. However, compared to the EURMAP-1 results, the PNL and Fay models give very similar predictions.

The primary reason for the discrepancy in model results is the input factors for wet and dry deposition rates. The EURMAP uses a wet deposition rate for SO_2 that is 60 times that used in the PNL, while the PNL assumes a wet deposition rate for SO_4 twice that of EURMAP (The Fay model does not distinguish between wet and dry deposition but its assumptions for total deposition are very similar to the PNL figures). The result is that EURMAP gives a very high localized pattern of wet deposition, and while these figures were based on a comparison of observations and calculations in Europe, there is no reason to believe that these parameters are reasonably for use in eastern North America. Furthermore, the EURMAP predicts seasonal and annual deposition but uses only one month from each season to simulate annual deposition patterns. It does not provide for the diurnal, seasonal or latitudinal variations that effect the SO_2 to sulfate conversion rates.

Both the PNL and Fay models have been compared to measured deposition values with good results (Mills, 1980; Marhoffer and Tong, 1980). Furthermore, the Fay results were evaluated by the State of Pennsylvania and showed good consistency with measured data (Hambright, 1980).

Summary

While much in the way of a rigorous validation of all the regional transport models remains to be done, it seems reasonable to conclude that the EURMAP results often quoted by EPA in determining cross-regional transport are suspect. Based on a limited review of available models, PNL and Fay models represent reasonable alternatives.

AIR AND PRECIPITATION MONITORING

Available data on acid precipitation, deposition and transport for the northeastern states comes from three basic sources: (1) networks that are part of long term, regional or national studies, (2) routine ambient air and precipitation monitoring activities of state or federal regulatory agencies, and (3) special studies by agency staffs, university researchers and other organizations. This section briefly describes these data sources and presents selected monitoring results for each type of source.

REGIONAL AND NATIONAL MONITORING NETWORKS AND RESULTS

There are three major, large scale atmospheric measurement networks currently in operation that collect precipitation chemistry data. The Multi-State Atmospheric Power Production Pollution Study (MAP3S) is a network of eight precipitation event stations in the eastern U.S. Originally established under DOE, the MAP3S network is now operated by EPA and its purpose is to define the physical processes of transformation and deposition and to develop models of these processes. There are three sites in the Northeast: Ithaca, NY, Whiteface Mountain, NY, and Brookhaven Lab, Long Island. The Sulfate Regional Experiment (SURE) sponsored by the Electric Power Research Institute (EPRI) includes nine sites in the eastern U.S. Precipitation events are measured including both wet and dry deposition. There is one SURE site in New England, at Montague, MA. The largest network is the National Atmospheric Deposition Program (NADP) consisting of over 70 stations nationwide. Weekly samples including both wet and dry deposition are collected. The NADP sites in the Northeast are listed in Table 2. Information from those networks is supplemented by a joint international program of WMO/NOAA/EPA. This network of 15 sites nationwide has been in operation since 1970. The one site in the Northeast is located at Princeton, NJ. Also, DOE's Environmental Measurements Laboratory (EML) operates a network of precipitation monitors.

TABLE 2

National Atmospheric Deposition Program (NADP)
Sites in the Northeast

CT: None

ME: Bridgeton
Greenville

MA: Truro (Planned, 1981)
Quabbin Reservoir (Planned, 1981)
Waltham (Planned, 1981)

NH: Hubbard Brook

NJ: Princeton/Washington Crossing

NY: Aurora
Huntington Forest
West Point
Chautauqua
Knobit
Bennett Bridge
Jasper

RI: None

VT: Bennington (Planned, 1981)

Results

Although studies using these networks are still ongoing, some preliminary assessments of the data have been accomplished that show the existence of acid precipitation occurring in the Northeast.

- A review of worldwide data available during the year 1977 shows that the major areas of acidity are located in the northeastern U.S. and western Europe (Miller, 1980).

- A summary of data from the major deposition monitoring networks for the period 1976-79 shows acid precipitation over the U.S. (Figure 2) (Wisniewski and Keitz, 1980).

- A joint review of MAP3S and EPRI network data indicated the following (Miller, 1980):

    1. The state of the art in deposition monitoring has improved so that data from independent networks can be combined. Year to year variations of annual acidity is known and seasonal variations of SO_4, NH, SO_4/NO_3 as related to acidity are beginning to be understood.

    2. The data from the MAP3S and EPRI networks show that large portions of the eastern U.S. have acidic precipitation as shown in Figure 3.

- Data from DOE/EML monitoring sites for 3½ years show average pH levels between 4.2 and 5.5 at west coast sites, about 4.4 at mid-continent sites, and 3.9 to 4.3 at east coast sites. Acid precipitation on the east coast is primarily sulfuric acid (Miller, 1980).

- A summary of NADP results by Ellis Cowling includes the following comments (Cowling, 1980):

    1. Acid precipitation is occurring in large regions of the eastern U.S. and Canada.

    2. This widespread deposition of acid precipitation and dry deposition results in large part from increased total emissions of sulfur and nitrogen oxides. These substances are transformed in the atmosphere to sulfuric and nitric acids, and deposited on vegetation, soils, surface water and materials (Bolin, et al., 1972; Likens, 1976).

Other studies have shown the precipitation and deposition of specific pollutants across the region.

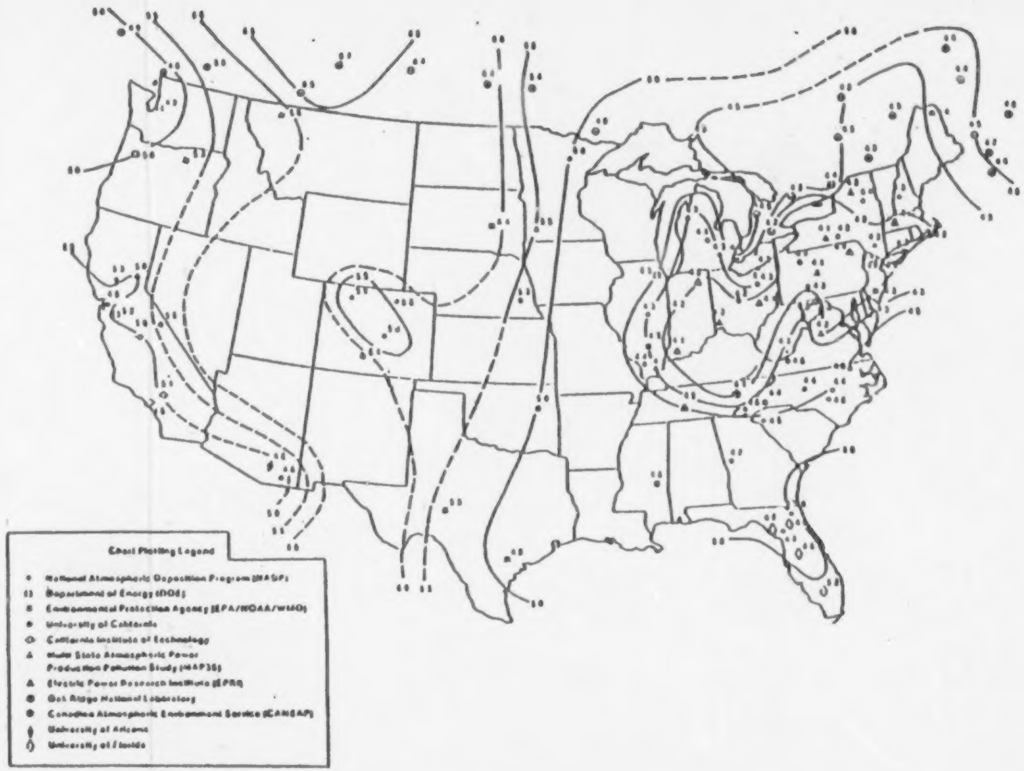
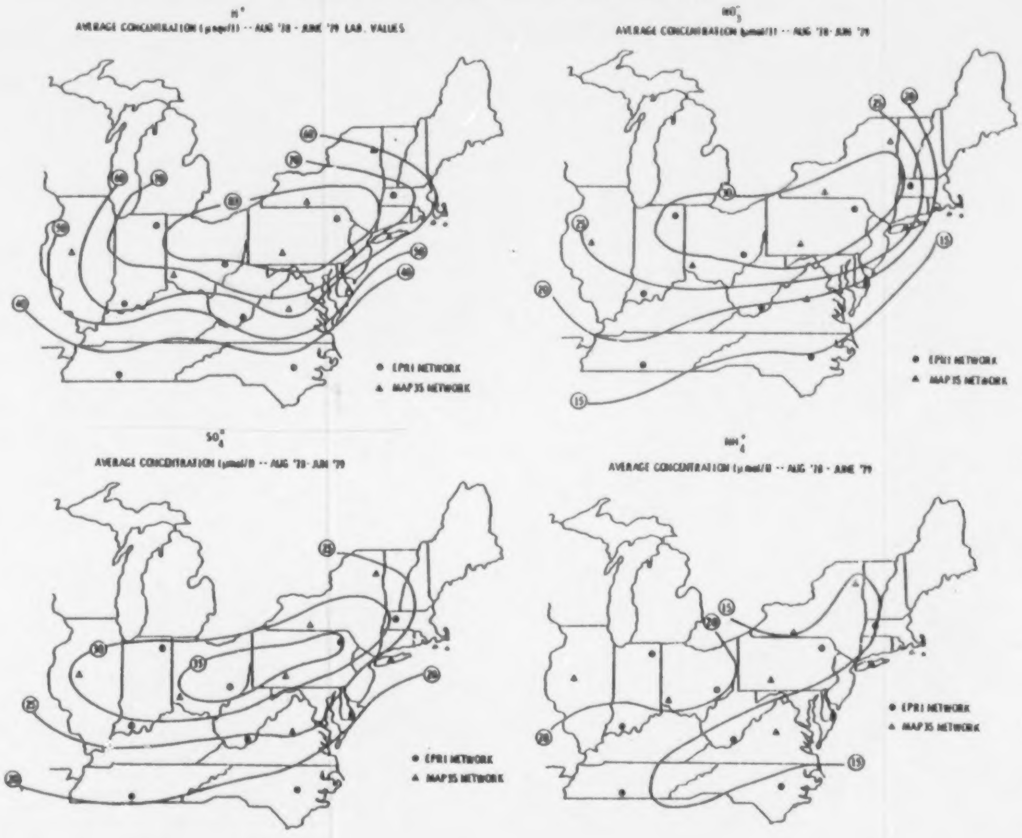


Chart Plotting Legend
• National Atmospheric Deposition Program (NADP)
:: Department of Energy (DOE)
Environmental Protection Agency (EPA/NOAA/WMO)
University of California
California Institute of Technology
Multi State Atmospheric Power Production Pollution Study (MAP3S)
Electric Power Research Institute (EPRI)
Oak Ridge National Laboratory
Canadian Atmospheric Environment Service (CANSAP)
University of Arizona
University of Florida

FIGURE 2. WEIGHTED MEAN pH OF PRECIPITATION 1976-79

To be submitted to SCIENCE; should be referenced
as Wisniewski and Keitz, (1980).

FIGURE 3. Isopleth Analysis of SURE and MAP3S/RAINE Precipitation Chemistry Data. Adapted From Analysis of Pack.


H⁺
AVERAGE CONCENTRATION (μeq/l) -- AUG '78 - JUNE '79 LAB. VALUES
NO₃⁻
AVERAGE CONCENTRATION (μmol/l) -- AUG '78 - JUN '79
SO₄⁼
AVERAGE CONCENTRATION (μmol/l) -- AUG '78 - JUN '79
NH₄⁺
AVERAGE CONCENTRATION (μmol/l) -- AUG '78 - JUNE '79
● EPRI NETWORK
▲ MAP3S NETWORK

Key for H^+

80 = pH 4.10
60 = pH 4.22
40 = pH 4.44

Source: Miller (1980)

- MAP3S data show that sulfur deposition in the eastern U.S. about 5 times greater than occurs naturally. Furthermore, this deposition is increasing over most of the northeast region (US DOE, 1979).

- Figure 3 shows the variations of the three major components of acid deposition, SO_4, NO_3, and NH_4 in the eastern U.S.

- The average concentration of SO_4 in precipitation falling on MA is measured to be 29 μmoles/l (2.8 mg/l). This is equivalent to an annual deposition rate of 32 Kg/ha. This data is the average from the EPRI site in western MA (Montague) and the DOE/EML site at Falmouth on the east coast. (Data from Falmouth was adjusted for sea spray effect.) (Cortell Assoc., 1980).

- Analysis of measurements from these same two sites in MA (Montague and Falmouth) for average monthly deposition of heavy metals (in ueg/$_m{}^2$) gave the following results: AL: 381, Fe: 107, Pb: 25.4, Zn: 245 (MA DEQE, 1980).

- Heavy metals deposition for lead (Pb) and Zinc (Zn) as reported by Lazrus, et al., and Davis and Galloway is shown in Figures 4 and 5 (Galloway, et al., 1980).

Summary

Extensive data are available from large scale monitoring networks, and the state of monitoring technology has advanced so that the data can be combined. Review of the data shows widespread acid precipitation and pollutant deposition in the northeast region.

FIGURE 4.

AVERAGE LEAD (Pb) DEPOSITION BY PRECIPITATION
SEPTEMBER 1966 to MARCH 1967

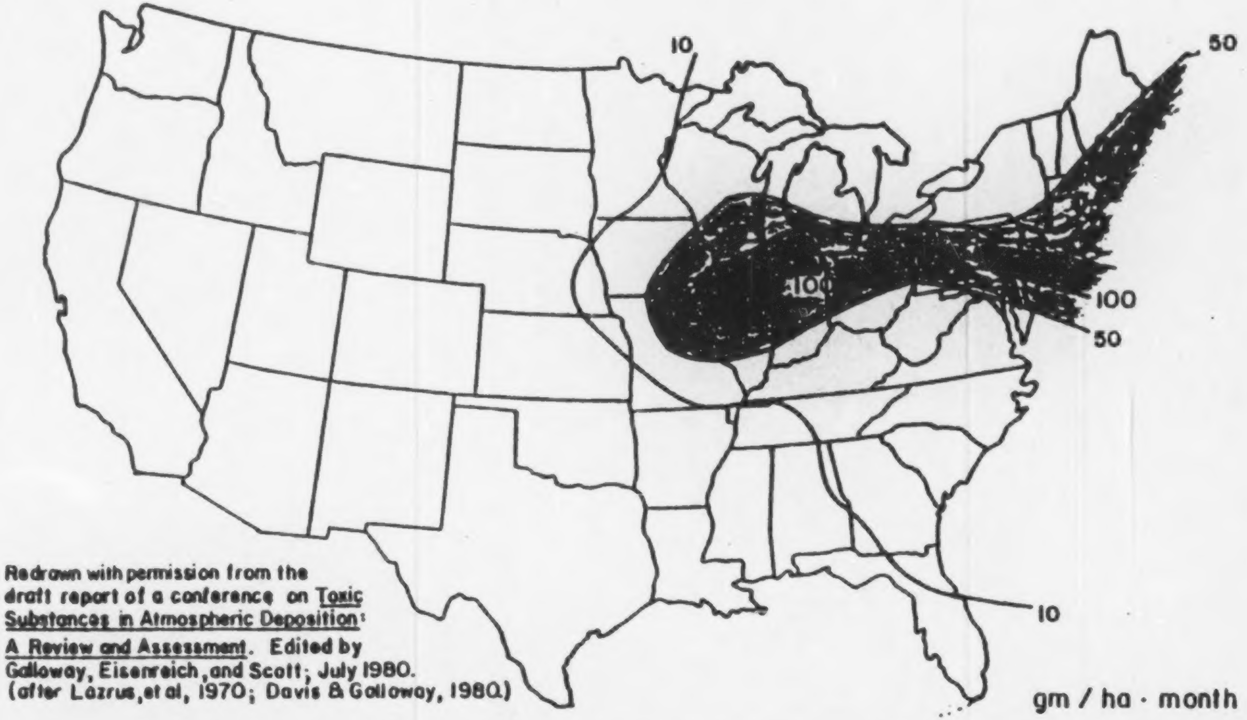


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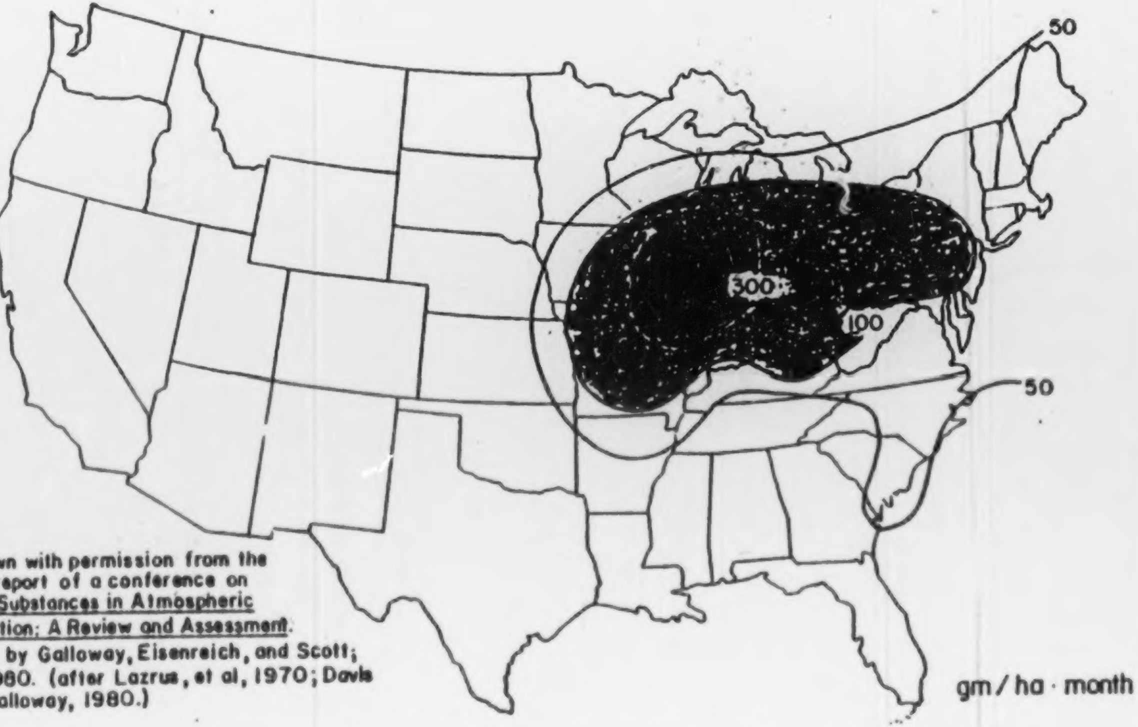
FIGURE 5.

AVERAGE ZINC (ZN) DEPOSITION BY PRECIPITATION
SEPTEMBER 1966 to MARCH 1967



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STATE REGULATORY AGENCY ROUTINE MONITORING ACTIVITIES

State air pollution regulatory agencies monitor both ambient air conditions and precipitation on a regular basis.

Ambient Air Monitoring

Sulfates in particulate form are routinely measured by state air agencies throughout the region. All states participate in the National Air Monitoring System (NAMS) network. A 24-hour sample of Total Suspended Particulates is taken every 12 days from designated sites in the Northeast, and is analyzed by the EPA Laboratory in North Carolina for sulfates as well as other components of TSP. The northeast sites contributing to this network in 1980 are listed in Table 3. (Note that these sites are subject to change.)

In addition to the federal NAMS system, most states also measure the sulfate fraction of TSP on a regular basis. The data from these efforts are summarized in Table 4.

A preliminary review of the data collected throughout the region indicate several important conclusions.

- All the Northeast states are recording relatively high levels of sulfates for both the annual average and the 24-hour maximum.
- The highest levels of sulfates occur during the summer months when local emissions of sulfates and sulfate precursors are lowest.
- Review of data from statewide networks show high levels of sulfates occurring on the same date, statewide, indicating that transport of sulfates is occurring.

Precipitation Monitoring

Rhode Island, Maine, and New Hampshire are currently measuring precipitation chemistry on a regular basis.

- The Rhode Island Division of Air Resources has measured pH at two sites on a weekly basis since summer 1980. Approximate values range from 3.4 to 7.2 with the median value of 4.0.

TABLE 3

National Air Monitoring System (NAMS)[*]
Sites in the Northeast
As of 1980

(one site per location unless otherwise noted)

CT: Bridgeport
New Haven
Waterbury

ME: Portland

MA: Boston
Cambridge
Fall River
New Bedford
Springfield
Worcester

NH: Concord

NJ: Bayonne
Camden
Cherry Hill
Elizabeth
Glassboro
Jersey City
Newark
Patterson
Trenton

NY: New York City (8)
Long Island (3)
Buffalo (4)
Niagara Falls (3)
Utica
Rome
Rochester (4)
Elmira
Syracuse (2)
Albany
Schenectady

RI: East Providence
East Greenwich

VT: Randolph

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[*] "NAMS Sites" as used here refers to sites for which states submit TSP filters to EPA, and for which EPA does sulfate analysis and data trends presentations as part of the NAMS reporting. These sites may not be official NAMS sites according to all EPA criteria.

TABLE 4

SUMMARY OF ROUTINE AIRBORNE SULFATE MEASUREMENTS

Agency	# Sites (1980)	# NAMS sites* (1980)	Length of record	Annual average 1980 (ug/m^3)	Max. 24 hr. 1980 (ug/m^3)	Time of year for max.
CT Air Compliance Unit	39	3	5+ years	4.2-8.4	-	Summer
ME Bur. of A.Q. Control	6	1	3+ years	8.44-11.85	42.5	Summer
MA Div. of A.Q. Control	10	6	10+ years	9.1-11.6	55	Summer
NH Air Resources Agency	6	1	3+ years	8.5	36	Summer
NJ Bur. of A.P. Control	14	9	3+ years	N/A	N/A	Summer
NY Div. of Air	41	29	5+ years	5.8-12.0	31.9	Summer
RI Div. of Air Resources	5	1	5+ years	7.3-10.4	40	Summer
VT Air & Solid Waste Program	2	1	5+ years	8-9	30	Summer

*"NAMS Sites" as used here refers to sites for which states submit TSP filters to EPA, and for which EPA does sulfate analysis and data trends presentations as part of the NAMS reporting. These sites may not be official NAMS sites according to all EPA criteria.

- The Maine Bureau of Air Quality Control measures pH in rain at two sites and New Jersey is establishing a network of four sites, one of which is operating now. For the Maine sites, measurements since November 1980 show pH of 4.0-5.5 with a mean of 4.6 at Arcadia and 3.7 to 5.3 with a mean of 4.3 at Bridgeton.
- The New Hampshire Water Supply and Pollution Control Commission measures individual storm events during the work week. The median pH value in 1980 was 3.8, and there is evidence that the pH has generally declined from an average value of 4.3 in the early 1970's.

Summary

Analysis of ambient sulfate data monitored by state air agencies shows that high sulfate levels exist across entire states at times when local sources of SO_2 and sulfates are lowest. Agency measurements of pH are limited, but substantiate the existance of acid precipitation in the region.

SPECIAL AIR AND PRECIPITATION MEASUREMENT ACTIVITIES

Numerous independent studies related to acid deposition have been conducted in the northeast region. This section provides brief summaries of collected precipitation data. Most data on sulfates and other air quality measurements used in these studies come from the state sampling networks described in the previous section.

Several large scale studies show that acid rain is occurring over the northeast region.

* Likens and Bormann (1974) reported that the annual mean pH during 1970-1971 was 4.03 at Hubbard Brook Experimental Forest, NH; 3.98 at Ithaca, NY; 3.91 at Aurora, NY; and 4.02 at Geneva, NY.

* Similar precipitation results are recorded by other investigations throughout the Northeast with the following weighted annual average pH values: Durham, NH - 4.3; Hubbardston, MA - 4.3; Thomaston, CT - 4.3; for spring and summer 1970, New Haven, CT - 3.8; Killingsworth, CT (30 miles east) - 4.3 (Likens, et al., 1972).

* During the summer 1980, four different storm events, measured at four different monitoring stations in VT, NH, and MA were recorded as having rain which measured pH $\leq$2.9 (MA DEQE, 1980).

Other studies with more limited regions of coverage show acid precipitation and deposition at locations throughout the region.

* Likens, et al. (1975) have noted an increase in nitrate in precipitation at Hubbard Brook, NH during the late 1960's and early 1970's.

* Weighted (for amount of precipitation) annual averages of precipitation pH for the years between 1964 and 1974 at Hubbard Brook Experimental Forest varied from 4.0 to 4.2 (Likens, et al., 1974, 1976, 1976a; Cogbill and Likens, 1974). For a given rainfall event, the lowest recorded pH was 3.0. Sulfuric acid was the predominant acid found at Hubbard Brook, with nitric acid next in abundance.

* Galvin and Cline (1978) studied the February and March snow cover of 1977 in the Adirondack Mountains of New York, and found that the most predominant anions in snow samples were nitrate and sulfate. Most of the precipitation was thought to originate inland, since no other anions, including Cl^-, were found in appreciable

amounts. This was consistent with the unusual weather patterns that winter. The source of the nitrate and sulfate was assumed to be anthropogenic since most biological sources were dormant at the time. Auto traffic was ruled out as a source due to low traffic levels in the area.

- Raynal (1980) reports that precipitation at Huntington Forest, NY had a volume weighted mean annual pH of 4.15 with hydrogen comprising 66.5% of the total cationic strength; sulfate contributed 62.9% of the total anionic strength; and nitrate 31.9%.

- Data collected by the USGS from 1965 to 1974 in NY documents the existence of acid precipitation for the entire period, suggesting that acid precipitation was occurring prior to 1965 (Galvin, et al., 1978).

- Precipitation measurements from two precipitation monitoring stations in MA over the past five years indicate the acidity of precipitation ranges from pH 3.0 to 4.6. One storm event in June 1980 was recorded at pH 2.9 (MA DEQE, 1980).

- Measurement of acid precipitation in New Jersey has been primarily limited to short term, independent studies of pH. The data makes it evident that throughout the 1970's precipitation with low pH fell across the state.

    1. From 1970 to 1972 collected precipitation samples in the Pine Barrens that yielded an average pH of 4.4 (Crerar, 1980).
    2. Consistent with these results were samples collected during 7 months in 1972 near Oyster Creek which showed an average pH of 4.24 (Likens, 1975).
    3. Values of pH as low as 3.7 in rainwater were collected at Trenton State College during 1974 (Letcher, 1974).
    4. A two year study between 1975 and 1977 reported mean pH between 4.32 and 4.25 at four NJ sites (Wolff, et al., 1979).
    5. Rainfall collected from May 1978 to April 1979 at McDonalds Branch of Rancoca's Creek measured an average pH of 3.9 (Johnson, 1979).

Summary

Extensive data are available from atmospheric measurements of transported pollutants and precipitation for the past 5 to 10 years. The monitoring technology has developed sufficiently so that data from a variety of independent monitoring networks can be compared. The data show that long range transport of fine particulates, especially sulfates, acid precipitation and dry deposition is being measured throughout the 8-state northeast region. The data record is sufficiently long and complete to say that the high sulfate concentrations and low pH values observed are consistent from year to year, and are not the result of unusual precipitation patterns in any one season.

REGIONAL IMPACTS OF ATMOSPHERIC DEPOSITION

So far, it has been established that meteorological patterns in the U.S. subject the Northeast to long range atmospheric transport, and that the Northeast is receiving considerable levels of air pollutants from outside the region, including acid rain and particulate pollutants. This next section examines the vulnerability of the region to acidified precipitation, and assesses the impacts of wet and dry atmospheric deposition on northeastern terrestrial and aquatic ecosystems, materials, visibility, and human health and welfare.

GENERAL EXTENT OF REGIONAL VULNERABILITY

There are several ways of examining the vulnerability of an area to acidification. Since buffering capacity of a hydrologic system is derived from the weathering or dissolution of bedrock and soils, examination of both these systems can give a rough indication of a region's ability to withstand high acid loadings. Areas with granite, granitic gneisses, or quartz sandstones have bedrock that is highly resistant to weathering, and will therefore contribute little buffering capacity to the watershed. Soils that have no carbonates and are not limed will also contribute little buffering capacity to any water leaching through.

* Studies of bedrock geology of the U.S. indicate that over 50% of the area of each of the northeastern states has low to medium/low buffering capacity (Norton, 1980).

* Studies of soils east of the Mississippi River took into account the total buffering capacity (measured by CEC, cation exchange capacity), base saturation (the percentage of exchange capacity which can be estimated by pH), management system imposed on the soil (cultivation, fertilization, liming), and presence or absence of carbonates. County-by-county maps for each state were compiled and show that a large portion of the Northeast contains soils that are, to some degree, sensitive to acid, especially areas in the Adirondack Mountains of New York (McFee, 1980).

Another aspect of an area's vulnerability lies with the volume and degree of acidified precipitation received. The most susceptible ecosystems in any region are those in the first mountainous areas that lie downwind of major pollution sources, especially those which receive large amounts of precipitation. This orographic precipitation can deposit heavy loads of acid and other pollutants on the first windward slopes of such a region.

- As far as the northeastern U.S. is concerned, the Adirondack Mountains are a good example of the orographic process. Easterly flowing air masses are cooled adiabatically as they rise over the mountains resulting in scavaging of pollutants on the western slopes. Unfortunately the geology and soils susceptible in this area are least capable of absorbing the impact (Donnelly and MacGregor, 1980).

When it comes to assessing the vulnerability of streams, ponds, and lakes to acidification, alkalinity (mg/l as $CaCO_3$) is a useful index. Alkalinity is the measure of a water's buffering capacity, and probably reflects that of the watershed's soils. Waters with alkalinity of $\leq$200 µeq/l (10 mg/l as $CaCO_3$ or 10 ppm) are believed to be sensitive to acidification (Altshuller and McBean, 1979). Levels of alkalinity in streams and lakes and reservoirs have far reaching consequences from impacts on fisheries management to the treatment of drinking water supplies.

- Efforts are now underway to reestablish salmon populations in several New England rivers including the Penobscot, Merrimack, and Connecticut Rivers, with a goal of restoring and maintaining spawning populations of salmon in selected rivers, as well as maintaining a sport fishery. As long as salmon fisheries in the U.S. are maintained by the stocking of hatchery reared juveniles or smolts, acid precipitation will probably not affect salmon returns in the near future. However, of 16 salmon rivers in Maine and three tributaries to the Connecticut River that are potential salmon rivers, most salmon rivers in all areas except Vermont and parts of Connecticut and Massachusetts are located in regions where the buffering capacity of headwater lakes and streams is very low (<200 µeq/l or 10 ppm). (See Figure 6, a map of surface water alkalinity of headwater lakes and streams in New England.) Some small tributaries are apparently already sufficiently acidic to affect the survival of salmon fry (the most sensitive life stage). If present trends continue, the reestablishment or continued existence of self-sustaining salmon populations could be jeopardized (Haines, 1980).

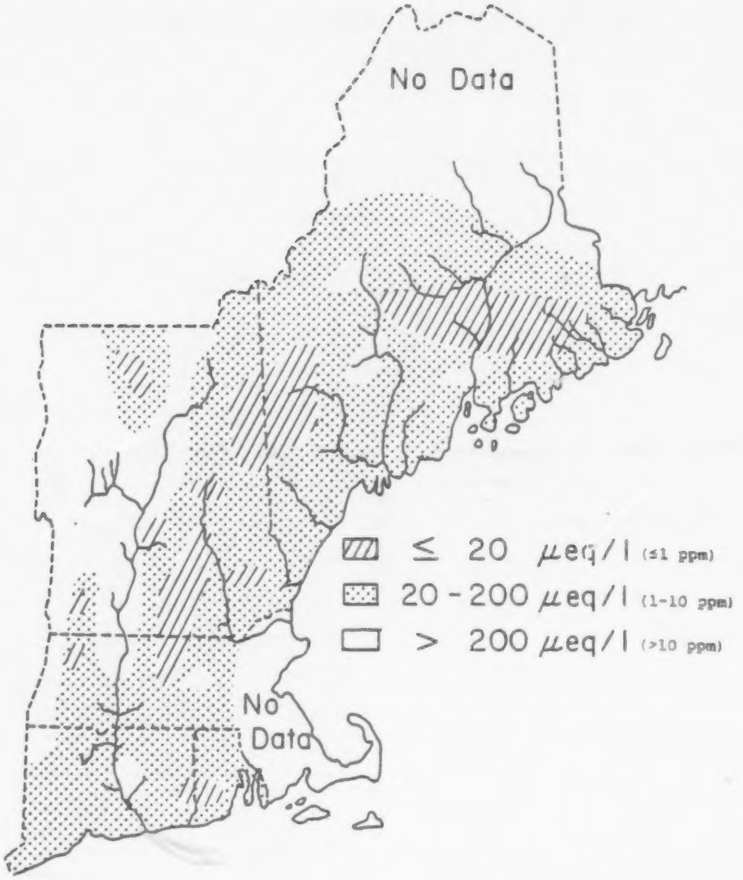

No Data
▨ ≤ 20 μeq/l (≤1 ppm)
▒ 20 - 200 μeq/l (1-10 ppm)
☐ > 200 μeq/l (>10 ppm)
No Data

FIGURE 6. SURFACE WATER ALKALINITY
of Headwater Lakes and Streams
(Haines, 1980)

- Total alkalinity samples taken from lakes in Maine showed that 89% of all the waters tested had values less than 20 ppm. Although a few hard water lakes were found, 94% of the waters tested had alkalinities less than 40 ppm; the extreme softness was concluded to be normal for Maine lakes (Mairs, 1966).

- Although a 1979-1980 survey of 120 lakes in Vermont showed the pH of the majority of the lakes sampled to be near neutrality (pH 7.0), the buffering capacity of the majority of the lakes was very low (< 20 ppm). This suggests that even though these lakes have not yet been acidified, they are potentially susceptible to continued inputs of acid precipitation. Large areas of lakes having alkalinities less than 10 ppm occurred in south central Vermont, and the extreme northeastern corner of the state (VT Dept. of Water Resources).

- Surveys of 70 lakes throughout Connecticut in 1974, 1978-1980, revealed alkalinity values less than 10 ppm in 44% of the lakes sampled. Twelve lakes had alkalinity less than or equal to 5 ppm; one value was as low as 2 ppm. Figure 7 shows that vulnerable lakes are located in almost all parts of the state, but lakes with the lowest alkalinities are found primarily in eastern Connecticut (Norvell and Frink, 1975; Norvell, 1980).

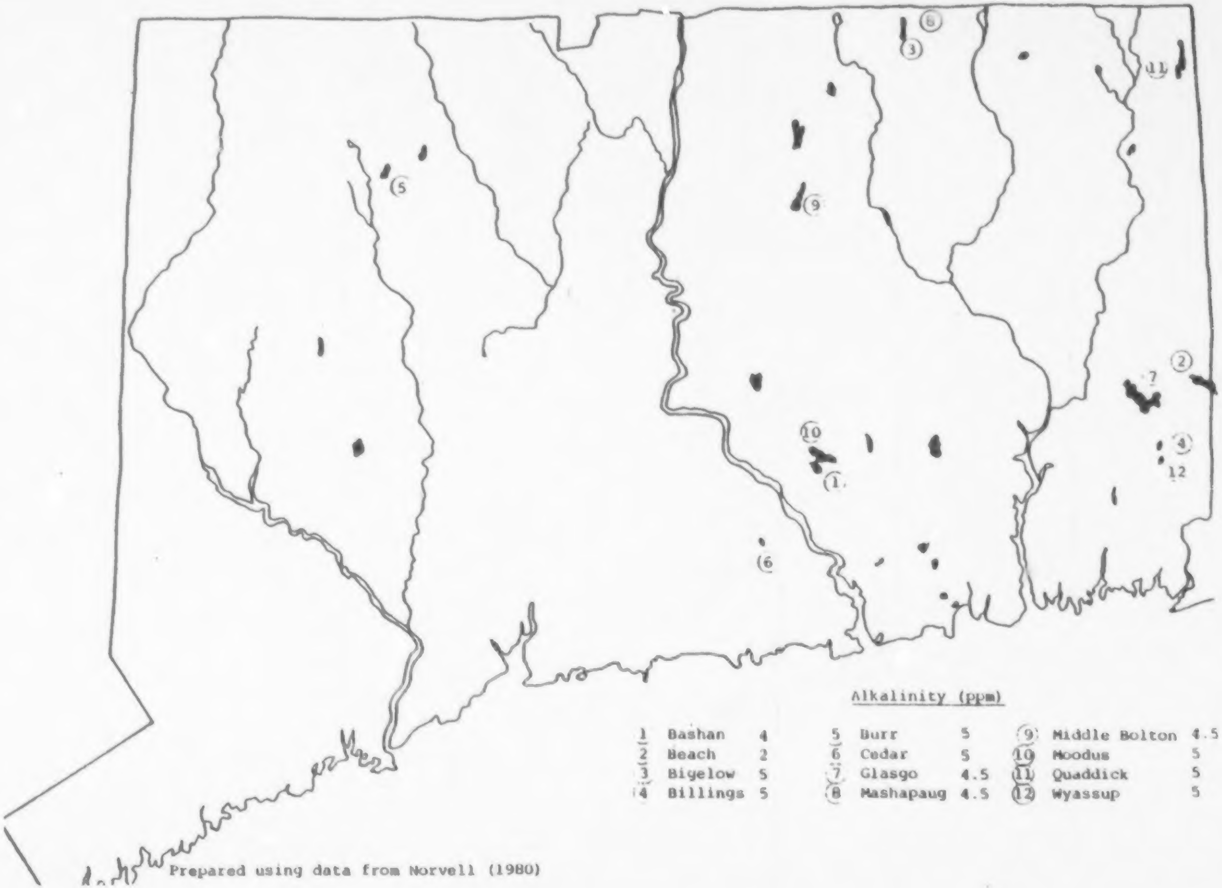
- The Scituate Reservoir system includes about 10% of Rhode Island's fresh surface waters and serves as the drinking water supply for nearly half the state. Methyl orange alkalinity ranges from about 3 to 7 ppm, giving the reservoir a very low buffering capacity (North, 1981).

- At least one half of the population of Massachusetts relies on surface reservoirs for drinking water. Of over 170 reservoirs surveyed in Massachusetts in 1975, it was estimated that 45-67% of the reservoirs were vulnerable to long term acid deposition. A map of these vulnerable reservoirs containing alkalinity ≤12 ppm is shown in Figure 8. A survey in 1980 of 154 reservoirs confirmed that over 60% of the reservoirs are vulnerable, representing 1.1 trillion gallons of water (MA DEQE, 1980-1981).

Summary

Due to weathering resistent bedrock geology, sensitive soils and water with extremely low buffering capacity, much of the northeastern U.S. is quite vulnerable to acid precipitation. Due to location in the transport path and local conditions, high elevations in the Adirondack Mountains of New York are especially vulnerable. Many streams, lakes and reservoirs in the region are very low in alkalinity and thus vulnerable to acidification. Fisheries managers in the region are faced with the knowledge that the ability of acid-sensitive fish to reestablish or continue self-sustaining populations could be jeopardized. Water supply managers are faced with the possibility that increases in treatment could be needed for many vulnerable waters before distribution to the public.

FIGURE 7. Location of 31 Vulnerable Lakes in Connecticut and Alkalinity Values for the 12 Most Vulnerable



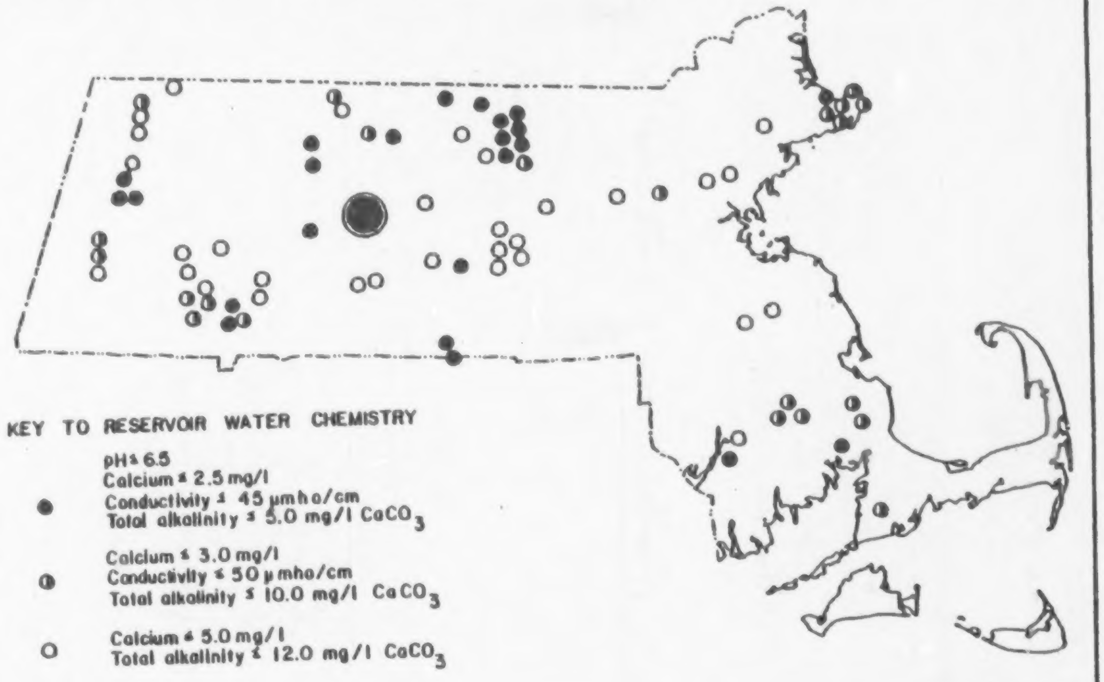
Alkalinity (ppm)

1	Bashan	4	5	Burr	5	9	Middle Bolton	4.5
2	Beach	2	6	Cedar	5	10	Moodus	5
3	Bigelow	5	7	Glasgo	4.5	11	Quaddick	5
4	Billings	5	8	Mashapaug	4.5	12	Wyassup	5

Prepared using data from Norvell (1980)

FIGURE 8. (Hagg, 1980)

APPROXIMATE LOCATION OF VULNERABLE DRINKING WATER RESERVOIRS IN MASSACHUSETTS


KEY TO RESERVOIR WATER CHEMISTRY
● pH ≤ 6.5 Calcium ≤ 2.5 mg/l Conductivity ≤ 45 μmho/cm Total alkalinity ≤ 5.0 mg/l CaCO₃
◐ Calcium ≤ 3.0 mg/l Conductivity ≤ 50 μmho/cm Total alkalinity ≤ 10.0 mg/l CaCO₃
○ Calcium ≤ 5.0 mg/l Total alkalinity ≤ 12.0 mg/l CaCO₃

based on 1975 data

TERRESTRIAL ECOSYSTEMS

Both atmospheric depositions of heavy metals and acid precipitation are impacting terrestrial ecosystems in the Northeast through effects on soils and soil chemistry, soil microorganisms, and forest vegetation.

- "Normal terrestrial cycling of metals in eastern North America ...has been altered by the increasing acidity of precipitation, and associated heavy metal deposition and mobilization. Pb and chemically similar metals are accumulating in soils. Al, Ca, K, Mg, and Mn are being leached from soils...work indicates that nutrient pools are diminishing in the northeastern United States, suggesting that decrease in forest productivity will occur" (Norton, et al., 1980).

- The accelerated leaching of Ca, Mg, K, Mn, and Zn has been documented along a transect running from southern Vermont to the Gaspe Peninsula, and correlates positively with the acidity of precipitation in the area. For example, there is more acid precipitation and more leaching of metals from soils in the southwest of the transect than in the northeast section (which is farther from the large midwestern sources of long range transport). Furthermore, an increase of some metals such as lead (Pb) in the soil has been documented and attributed to atmospheric deposition (Hanson, 1980).

- When soil samples from a 1964 study were compared with samples obtained in 1979 from Camel's Hump, VT, significant increases in heavy metals were noted. Lead, copper, and zinc increased from 50 to 100% over the previous studies, with higher increases observed with higher altitude (a typical increase for Pb was from 170 ppm to 300 ppm). These heavy metals are known to alter plant growth and development. Dramatic increases in soil organic matter (up to 30%) were observed and attributed to reduced microbial action on detritus, due to acid rainfall (Vogelman, et al., 1980a).

- In relatively unpolluted regions of the U.S. with no major atmospheric inputs of leaching agents, carbonic and organic acids dominate the soil leaching process. Conversely, analysis of soil water and ground water samples from the White Mountains in NH show that atmospheric inputs of acids now dominate the soil solution chemistry. Sulfate anions supply 76% of the electrical charge balance in the leaching solution. This result implies that atmospheric inputs of sulfuric acid provide the dominant source of both hydrogen ion for cation replacement and mobile ions for cation transport of subalpine soils of the northeastern region affected by acid precipitation (NH) (Cronan, et al., 1978).

- In some Northeast forests, most of the atmospheric sulfuric acid is neutralized deep in the mineral soil rather than in the fir forest canopy or the forest floor. This gives the acid plenty of opportunity to impact forest vegetation and soils (Cronan, 1980).

- Leaching of nutrient bases by sulfate represents a serious threat to the nutrient status of Adirondack Mountain forest soils since rates of nutrient loss from the soils exceed inputs from precipitation. Furthermore, no nitrifying bacteria could be found in soils with a pH range 3.1 to 4.1; population levels and species diversity of bacteria, fungi, etc. in the Adirondack soils were lower than in similar sites elsewhere (Raynal, 1980).

- A large fraction of precipitation that falls on upper elevations of eastern mountains is in the form of fog. At Camel's Hump, VT as much as six inches of precipitation collected on trees at the 2,000 ft. level is from fog; up to 30 inches of precipitation per year was collected from fog at the summit (3,800 ft.). Total precipitation in the boreal zone may be as much as 50% fog water, a ratio confirmed by work on another VT mountain. Data from the summer of 1979 indicate that fog is close to five times more acidic than rain, thus contributing greatly to the acid loads on the fragile soils of upper elevation conifer forests (Vogelman, et al., 1980a&b).

- Computer comparisons of vegetation inventories from the summer of 1965 with the summer of 1979 at Camel's Hump, VT showed large reductions in red spruce populations, and smaller but significant alterations in other boreal and hardwood species. Along the whole slope studied from 1,800-3,800 ft. altitude, tree productivity decreased in general, with maples down 60% and beech down 30%; yellow birch productivity appeared to be up 22%. At mid-elevation (2,600-2,800 ft.), red spruce productivity was down 40 to 45% in terms of basal area, and down 50% in terms of stems per acre. Similar plots maintained on mountains in VT north and south of Camel's Hump substantiate the intensive work done on the hump itself (Vogelman, et al., 1980a&b).

Summary

Some types of heavy metals are accumulating in Northeast soils from atmospheric deposition. Other metals and some nutrients are being leached from soils by acid precipitation, as soil leaching chemistry has changed from carbonate to sulfate based and microbial soil action has decreased. Much of the acid load on high altitude forest is in the form of fog, and forest productivity in some areas has decreased over the past 14 years.

AQUATIC ECOSYSTEMS

Atmospheric deposition and subsequent leaching of metals from soils are affecting aquatic ecosystems in the Northeast, especially at high elevations where glacial overburden is minimal, and natural buffering capacities are low. Changes in the water chemistry of lakes and streams are impacting the survival of certain ecosystems involving both fish and amphibians.

A pH range of 5.0 to 6.0 will eliminate many acid intolerant plant and animal species, disrupting existing biological communities; such disruption may reduce the total food resources available to fish, or force fish to shift to less beneficial foods; major extinctions of acid intolerant fish populations start at pH 5.0; below pH 4.5, no fish species can survive (Hendrey, et al., 1980).

- Early research suggests that in the western Adirondack Mountains of NY, the pH of several lakes had been lowered by the presence of sulfate and nitrate in precipitation (Likens and Bormann, 1974).

- In 1975, a comprehensive study of water chemistry and fish surveys of 217 Adirondack region lakes above 2,000 ft. elevation showed that 51% of the lakes had surface pH values less than 5.0. There were no fish in 90% of these acidified lakes, compared with only 4% of the lakes being similarly acidified and devoid of fish in 1927-37 (Schofield, 1975).

- The latest Adirondack sportfishing resource inventory determined that nearly 11,000 acres of water have reached the critical state of acidification, and much of this being remote former brook trout ponds. In lakes both above and below 2,000 ft., it is estimated that 180 former brook trout ponds (7,130 acres) are now devoid of fish. A former sportfishing yield of 5 lb. fish/acre/year is now estimated at 2 lb./acre/year, representing an estimated loss of some 22,000 lbs./year, attributed to atmospheric acid (Pfeiffer and Festa, 1980).

- Although the initial concern in the Adirondacks was with the acidification and loss of cold water brook trout ponds, vulnerable warm water habitats and food chains are also being lost or endangered. In the Adirondack region, a number of former bass lakes, including Woodhull, Big Moose, and Canada Lakes have lost their smallmouth bass population, and reproductive failure associated with increased acidity is suspected. Several other marginal pH bass waters including Cranberry Lake and Tupper Lake appear to be suffering marked population declines (Pfeiffer and Festa, 1980).

- NH Fish and Game Dept. started stocking trout in NH ponds around 1939. In 1971, reports started coming into the Department about poor fishing in certain ponds (Thoits, 1981). A 1980 survey of seven alpine lakes above 2,000 ft. documented the absence of stocked fish in ponds with low pH (Towne, 1981).

- Fifteen years ago, the MA Dept. of Fisheries and Wildlife recognized the need for liming certain stocked trout ponds on Cape Cod in late winter and early spring. Although natural populations of yellow perch were able to cope with springtime drops in pH, acid sensitive trout were not able to survive (Oatis, 1980).

- Although much of VT has sufficient buffering capacity to withstand the effects of acid precipitation, lake pH data from 1979 and 1980 surveys reveal that two main geographical areas in the State have lakes with pH below 6.5 - the southern third of the Green Mountains, and extreme northeastern VT (VT Dept. of Water Resources, 1980).

Throughout the year, pH and alkalinity in lakes and streams fluctuate in response to seasonal and climatic factors. Both are generally lowest in the spring, especially during snowmelt (Haines, 1980).

- In a study of three ME rivers, the expected seasonal pH and alkalinity pattern was borne out, in spite of an abnormally small snowpack during the winter of 1980. Even though spring snowmelt was not a major hydrologic event, the pH of two major rivers declined to 6.0 (from a summer value of over pH 7.0). The pH of a small tributary decreased to less than pH 5.0. All sites had very low alkalinity at this time, so that any major input of acid, as from the melting of a heavy snowpack, could have severe consequences for salmon fry in these streams (Haines, 1980).

Much of the acid in atmospheric deposition is linked with sulfates, so it has sometimes been beneficial to look at the presence of sulfates in aquatic ecosystems.

- An accumulation of sulfate in the biomass of mountain streams was found in Hubbard Brook Experimental Forest, NH (Vitousek, 1977).

- Water column sulfate levels in Quabbin Reservoir in central MA have increased from 1 mg/l in 1970 to 7 mg/l in 1979 (Ferullo, 1981).

- A rise in sulfate concentration of around 2 to 3 mg/l has been noted in a prominent reservoir in Rhode Island, from before 1965 to the present (Taylor, 1981).

Amphibians, as well as fish, are adversely affected by increased acidity of aquatic ecosystems.

- One third of the salamanders, and half of the frogs and toads, in the U.S. breed in ponds, some of which are becoming abnormally acidic in the Northeast. Spotted salamander egg mortality is greater than 65% in ponds with higher acidities - pH 4.5 to 5.0 (Pough, 1976).
- In eastern MA, drastic declines in spotted salamander populations were witnessed as egg mass mortality increased and pond pH decreased (Lazell).
- The effects of acid precipitation on the embrionic mortality of spotted salamanders and Jefferson salamanders was also noted in the Connecticut River Valley of MA (Cook, 1978b).

As discussed in Section IV B, acid precipitation can mobilize metals from soils and bedrock, can leach these metals from the watershed into a lake, stream, or groundwater.

- Studies in the White Mountains of NH and the Adirondacks of NY indicate that soil leaching and mineral weathering by acid precipitation lead to comparatively high concentrations of dissolved aluminum in surface and groundwaters (Cronan and Schofield, 1979).
- The amount of acid reaching the subalpine zone in NH may be 1½ times that at lower elevations because of orographic effects and local climate. Surface waters at these elevations are much richer in dissolved aluminum than streams lower in the watersheds (Cronan, 1980).

Metals can also be deposited directly in a lake or stream as the result of atmospheric transport. Changes in lake pH from acid precipitation can affect the solubility of metals, and will tend to increase the concentrations of metals in the water column, as opposed to allowing them to settle out or to remain in lake sediments. Metal deposition in New England lakes has been increasing since the turn of the century.

- Chemical analyses of sediment cores for three high altitude oligotrophic lakes in essentially undisturbed watersheds in New England reveal increases of lead (Pb) and zinc (Zn), beginning around 1900 (and slightly later in lakes farther to the northeast). The increasing trend continued to the present for Pb. Zn values decreased in sediments near the surface, apparently because of acid leaching from the sediments. The pH of two of the ponds was 4.7, with no alkalinity recorded - 0.0 ppm $CaCO_3$ (Norton, et al., 1981).

Many metals deposited or leached into lakes and streams are potentially toxic to fish.

- A survey of 57 Adirondack lakes in August 1975 showed that high acidity was significantly correlated with the absence of fish and with concentrations of lead in the water column (mean pH concentration 2-5 µg/l). In two instances, there were relatively high concentrations of Pb (4.9 µg/l) and enough cadmium (5.4 µg/l) to cause concern. The source of acidity for all lakes was attributed to atmospheric sulfate which was not neutralized by contributing substances (i.e., calcium) from the drainage basin (Wood, 1978).

- Even at acidified lake pH values that are not physically harmful to fish, field and laboratory experiments in the Adirondacks of NY have demonstrated that toxic conditions for fish may be produced by dissolved inorganic aluminum (Schofield and Trojnar, 1980; Schofield, 1980). Such increased aluminum concentrations can lead to fish mortality at 0.2 µg/l or higher (Cronan and Schofield, 1979).

Summary

As pH in lakes, streams and ponds is being lowered, loss of fish, and the interference with reproduction of fish and amphibians is occurring across the Northeast particularly at high elevations where natural buffering capacities are especially low. Additional changes in water chemistry due to the leaching of aluminum from soils or the deposition of metals such as lead and cadmium are also posing a danger to aquatic ecosystems.

MATERIALS

The presence of acid rain and particulate pollutants is causing the accelerated weathering of building and monumental stone and metals, as well as the deterioration of mortar, concrete, textiles, paper, paint and leather.

- Degradation of material objects in the eastern U.S. results in an estimated $13 billion loss annually (Tschirhart, 1980).
- The materials damage to artistic works and historic structures by corrosive rain, drizzle, and particulate pollutants is especially serious, often permanent, and costly to repair, if possible (Winkler, 1981).
- Massachusetts estimates that the refurbishing of bronze statues alone would cost the Commonwealth $7.8 million, with a yearly maintenance cost of $290,000-$370,000 (VanArsdale, 1980).

The deterioration of masonry materials in historic buildings occurs in several ways: acidic substances generated from air pollutants can dissolve susceptible materials such as limestones, marbles, and calcerous sandstones. Acid also destroys surface modeling and sculpted details, causes the rapid erosion of lime mortar and the etching of brick. Furthermore, the deposition of sulfate salts on the surface of building materials (efflorescence) and below the surface (subflorescence) weakens the internal structure (induration) that binds the grains of solids together (Lewin, 1981; Selwyn, 1981).

This deterioration seems to be occurring at a much faster rate than in the past.

- One example of deterioration in architectural art is the current condition of Oakes Ames Memorial Hall, designed by H. H. Richardson (1881) in North Easton, MA which includes soiling, efflorescence, and stone decay of the historic brownstone (Selwyn, 1981).
- The sandstone of Essex Institute (Salem, MA, circa 1850), especially of the portico columns, has eroded remarkably during a period of observation from 1964 to 1981. If erosion during the first 135 years had occurred at the rate observed during the past 15 years, there would be no stone left on the building today (Selwyn, 1981).

Summary

Buildings and monuments in the Northeast, made of stone, masonry, and metal, are deteriorating due to the deposition of acid rain and particulate pollutants. The damage in many historical structures is especially serious, and now appears to be occurring at an accelerated pace.

VISIBILITY

Visibility refers to the greatest distance toward the horizon that prominent objects can be seen clearly with the naked eye. Visibility is especially important in recreational areas of New England and New York because of its aesthetic value to the tourist industry. Tourism is vital to New England's economy, particularly in the rural and mountainous areas. A visitor who has driven for several hours and then hiked for several more, only to find that there is no view from the top of the mountain, is not likely to return (Poirot, 1981a).

Visibility is reduced by particles in the atmosphere which scatter and absorb light. For example, Charlson, et al., (1974) have indicated that sulfate particles, because of their tiny size and hygroscopic nature, are two to three times as efficient as other aerosols (on a weight basis) in scattering light. Trijonis and Yuan (1978) estimate that sulfate particles account for about half of the total extinction of light in the atmosphere.

- The formation and long range transport of regional scale haze episodes in the Northeast have been studied by numerous investigators (Tong, et al., 1976; Husar, et al., 1976; Lyons and Husar, 1976; Galvin, et al., 1978; Hidy, et al., 1978; Tong, et al., 1979; and others). A common finding has been that such haze episodes are characterized by high sulfate concentrations and poor visibility, and usually coincide with slow moving high pressure systems which have stagnated over areas with high sulfur dioxide emissions, such as the Ohio Valley, and then moved into the Northeast.

- Long term studies by Trijonis and Yuan (1978) have shown that visibility has decreased 10 to 40% between 1953-55 and 1970-72 in non-urban locations in the Northeast. These results are supported by the findings of Husar, et al. (1979) who noted a 10-20% decrease in New England's visibility during the same period.

- Both these two teams of researchers (Trijonis and Yuan, 1978 and Husar, et al., 1979) have found that the most dramatic visibility reductions in the Northeast occur during the summer season, when 25-60% reductions have been experienced (Trijonis and Yuan, 1978). This is an important point, for although skiing is an important winter industry in the Northeast, most out-of-state visitors come during the summer months. For example, Vermont, known as the ski capital of the East, actually receives 2/3 of its tourism in the summer.

- Visibility in the Northeast now averages less than 13 km (8 mi) (Costle, 1980). According to EPA, regional visibility trends in the eastern U.S. are strongly associated with sulfur oxide emissions, especially from power plants.

- On a clear, low sulfate day in September 1980, there was a splendid view of Bolton Mountain, Camel's Hump, and finally Mt. Ellen, at a distance of about 30 miles from the south ridge of Mt. Mansfield, VT. Six days earlier, on a day when sulfate measurements were moderate, Camel's Hump was just barely visible at a distance of 15 miles. On a high sulfate day in June of the same year, Bolton Mountain, at a distance of about 5 miles, was not even visible. (Relative humidity was nearly the same (about 50%) on all three sampling days (Poirot, 1981b).

- As shown in Figure 9, from Whiteface Mountain in the Adirondacks of NY, visibility was over 50 miles on August 24, 1977, when winds were from the northwest. Two days later visibility was less than 5 miles when winds were blowing from the southwest, having traversed over the source region of highest SO_2 emissions in the U.S. - primarily power plants in the Ohio Valley (Lyons, 1980).

- Relative humidity is also an extremely important factor in determining visual range in the Northeast. The combined effect of high relative humidity and high atmospheric sulfate causes a reduction in visibility which is even greater than the sum of each individual effect. A regression analysis performed on Vermont airport visibility data indicates that relative humidity alone would explain 29% of the variation in visibility, sulfate alone would explain 19% of the variation, but relative humidity and sulfate combined explained 60% of the variation in visibility (Poirot, 1981a).

- Not only is visibility affected by light dispersion - climatological effects are also involved (Higgins, 1977). Reduction of available sunlight reduces the potential for solar energy production in the Northeast, where the increasing price and demands on traditional energy sources dictate the development of alternative technologies. The reduction of sunlight available for plant photosynthesis, alterations in the length of growing season, and changing precipitation patterns, all influence the agricultural and forest productivity of the Northeast (Abrams, et al., 1981).

Summary

Visibility in the Northeast is being reduced, especially during summer months. This reduction is primarily due to light dispersion caused by the long range transport of sulfate particles, and is exacerbated by the high relative humidity in the region. The greatest reduction in visual range occurs during the most damaging time of the year for the tourist industry in New England. Light dispersion also reduces available sunlight for solar energy production and plant photosynthesis, and may have other climatological effects.

HUMAN HEALTH AND WELFARE

The long range transport of air pollutants can endanger human health and welfare both indirectly and directly. Indirect effects result, for example, from impacts on drinking water quality and the edibility of fish taken from affected waters, whereas direct health damage results from the inhalation of air pollutants such as sulfate. This section presents research results that support the growing concern over health effects related to acid deposition.

Indirect Health Effects - Drinking Water Quality

Many of the same lakes discussed as being susceptible to acid precipitation or damaged by highly acidic loadings are sources of public drinking water supply, too. The U.S. drinking water standard for pH ranges from 6.0 to 9.0, and many raw water supplies in the Northeast fall below the lower acceptable level.

* The Scituate Reservoir system serves as the drinking water supply for nearly half the State of Rhode Island. The annual average pH ranges from about 5.8 to 6.3. The alkalinity which ranges from 3 to 7 mg/l offers little buffering capacity, and the reservoir has required pH adjustment before distribution for many years (North, 1981).

In watersheds subject to acid precipitation and suitable rock and soil formations, metals such as lead, copper and aluminum can leach into both surface and groundwater supplies.

* Three Adirondack water supplies which do not employ metal distribution piping showed copper and lead levels at or slightly above safe drinking water standards, with elevated levels of aluminum - 0.05 - 1.4 mg/l (Fuhs, 1979a).

Lead

The problem with drinking water supplies that are both relatively low in pH and have very little buffering capacity is that the waters tend to corrode metal distribution systems (few studies are available on their leaching impact on plastic pipes). For example, most lead in drinking water is due to corrosion problems rather than naturally occurring lead in raw water

(US EPA, 1976). Lead has a solubility of 0.5 mg/l in soft water, and 0.003 mg/l in hard water, although higher concentrations of suspended and colloidal lead may remain in the water (US EPA, 1972). Acidic soft water in particular can dissolve appreciable concentrations of lead (Crawford and Morris, 1967).

The U.S. drinking water standard for lead is 0.05 mg/l for health reasons. Ingestion of higher levels can affect the nervous system especially in children.

Lead pipes were used in the water distribution systems of many older homes in the Northeast, and have been subject to leaching by corrosive waters typical to many areas in the region. Lead can also be leached (along with silver) from soldering compounds used to join the copper pipes used in newer homes.

* A 1974 sampling of Boston, MA, tap water found concentrations of lead that were up to five times the permitted level in drinking water. The problem was solved by treating the water to raise the pH (Environment Reporter, 1981).

* Several years ago, older homes in Bennington, VT that were serviced with lead water pipes were found to have high levels of lead in the tap water. The town's water supply was taken from Bolles Brook, a small mountain stream low in alkalinity and pH. The raw water supply was frequently below the federal drinking water standard of pH 6.0, and values as low as pH 4.13 were recorded (unpublished data). In 197[illegible], Bennington spent $37,000 for large amounts of sodium hydroxide and sodium bicarbonate to reduce the corrosivity of the drinking water supply (Poirot, 1980).

* In some Adirondack area well waters in New York, lead concentrations were found ranging from 0.1 to 0.2 mg/l, up to four times the U.S. drinking water standard (Fuhs, 1979b).

Copper

Most newer water supply distribution systems use copper pipes, which can also be corroded by acidic, poorly buffered, soft water supplies. The U.S. drinking water standard for copper is 1 mg/l, for aesthetic reasons, the taste threshold for copper is 2 mg/l (Fuhs, 1979b).

- Surface waters in the Saranac Lake area of New York have a pH range from 6.7 to 7.8, are low in alkalinity and calcium, and are corrosive as defined by the Langelier Saturation Index. One water supply at Camp Adirondack has relatively low natural levels of copper (<0.05 mg/l). However, one residence with copper pipes using the supply had 0.67 mg/l Cu in the hot water line, and 0.44 mg/l in the cold water line. Although these levels are within the drinking water standard, the example illustrates that a substantial amount of copper is being leached from the distribution system (Fuhs, 1979a).

- The raw drinking water of all of the 30 public and semipublic water supplies studied in the Adirondack Mountains of NY are corrosive, although pH values are rarely below 6.0. The buffering capacity of the water is so low (often under 10 mg/l total alkalinity as $CaCO_3$) that the addition of chlorine makes the water significantly more corrosive. Copper levels at the tap can easily exceed the U.S. drinking water standard of 1 mg/l, and can rise as high as 7 mg/l when the water is allowed to stand in the pipe for several days (Fuhs, 1979b).

- Residents of the Adirondacks with copper distribution systems in their residences were advised to flush their lines in the morning to avoid water which had a metallic taste from copper, and which may contain other toxic metals released from piping and soldered joints (Fuhs, 1979a). Residents were also advised not to install copper piping in new construction (Fuhs, 1979b).

Aluminum

In spite of the fact that aluminum levels in water may be high due to leaching from soils and bedrock or from the alum used in water treatment systems, aluminum in public water supplies has not generally been considered a public health problem since very little of the aluminum ingested is absorbed in the alimentary canal (McKee and Wolf, 1963). However, there is a small segment of the population requiring hemodialysis that can be severely affected by aluminum in drinking water if that water is used to prepare the dialysate without sufficient treatment. Aluminum in the dialysate is introduced directly into the bloodstream, bypassing the body's normal absorption barriers, and has been associated with such disorders as brain and bone disease. For example, multiple outbreaks of dialysis encephalopathy (DE) have been reported where high levels of aluminum were present in dialysate, either by its inadvertent addition to, or because of inadequate removal of aluminum from, water used in dialysate composition (Berkseth and Shapiro, 1979).

- A survey of 1,293 patients in 18 dialysis centers in Great Britain showed a highly significant rank correlation of the incidence of both fracturing dialysis osteodystrophy (bone disease) and dialysis encephalopathy with the aluminum content of the water used to prepare dialysate. (Patients using deionizers to treat the water used in dialysate preparation were excluded.) "Of 10 patients in their twenties on home dialysis with two individual water supplies, none survived 2 years: all died of dialysis encephalopathy, osteomalacia, or unexplained cardiorespiratory failure. The aluminum content of their two water supplies ranged from 300 to 1200 µg/l." (Parkinson, et al., 1979).

- Between 1975 and 1977, the Minneapolis Regional Kidney Disease Program experienced an epidemic of dialysis encephalopathy (DE). One dialysis facility responsible for 87% of the 45 patients involved in the outbreak had high aluminum concentrations in the dialysate from 1974 through 1976, during which time the deionizer which treated the high aluminum tap water malfunctioned and finally ceased to work. The source of high aluminum in the tap water was the aluminum sulfate used in treating organic contaminants from the Mississippi River. During the 1976 DE episodes, tap water contained 386 µg/l, and the dialysate 200 µg/l of aluminum. Continued exposure to high aluminum dialysate after the onset of symptoms in dialysis patients was associated with rapid progression of the encephalopathy and a 91% mortality - average time from onset of DE to death was 3.4 months (Berkseth and Shapiro, 1979).

- "Adequate water treatment appears to be essential from the start of hemodialysis to prevent the development of usually irreversible disorders. The ideal or safe aluminum content of dialysate has not yet been established, but is probably below 50 µg/l, and more likely below 20 µg/l. This level can be achieved by reverse osmosis and polishing deionization, or possibly by deionization alone when suitable combinations of resins are used." (Parkinson, et al., 1979).

- Some states in the Northeast have set stringent standards for aluminum content of dialysates. NH has set a limit of 10 µg/l, and reverse osmosis is the treatment routinely used on the tap water for dialysate. Deionization, however, is quite expensive, and may not be available in some areas (Towne, 1981).

Since adequate water treatment may not always be provided in hemodialysis, aluminum content in tap water is a concern. Although New England water treatment has traditionally consisted of disinfection alone, due to strict policies of watershed protection, some raw water sources, especially those from major rivers receiving wastewater discharges, require treatment with products that may contain aluminum.

- Throughout the State of NH, 11 water supply treatment works use alum (aluminum sulfate) to aid flocculation and removal of contaminants (Towne, 1981).

Of growing concern is the possibility that public and private water supplies in the Northeast that have high aluminum concentrations resulting from the acid leaching of soils and rocks may be used for dialysate preparation with inadequate treatment by deionization.

- Concentrations of aluminum as high as 550 µg/l were found in several high altitude ponds that serve as the water supply for Lincoln, NH (Towne, 1981).

- Spot checks of a few private water supplies showed 450 µg/l aluminum in one dug well with a pH 5.5, and 100 µg/l aluminum from a spring with a pH of 4.2 (Towne, 1981).

Indirect Health Effects - Fish Consumption

Aside from acid deposition leaching metals into drinking water supplies, the deposition of metals and other contaminants into surface waters by atmospheric transport also presents another indirect human health problem. Even though fish that live in water subjected to atmospheric deposition may not be harmed, those fish may be unsuitable for human consumption.

- Although levels of mercury in the drinking water in the Adirondack area studied are very low, a major concern is the accumulation of mercury in fish. Concentrations in the edible portion of fish in excess of 0.5 mg/kg have been found in two large remote lakes which have never been subject to local industrial pollution. The geology of the area and analyses of over 60 samples of sediments from tributaries in the area do not indicate geologic sources of mercury. In this area of New York, an advisory was issued that residents should restrict intake of fish to one meal a day, and that pregnant women and nursing mothers should refrain from eating freshwater fish (Fuhs, 1979b).

- Mercury levels in fish from some remote lakes in Maine are greater than 2 mg/kg exceeding new FDA standard of 1 mg/kg for human consumption, although the fish are not affected at these levels. No mercury can be attributed to industrial or agricultural sources, and there is no evidence in the local geology of any mercury deposits. It is concluded that atmospheric deposition is affecting the mercury cycling and increasing the mercury uptake in fish (Akielaszek and Haines, 1981).

* Also of concern are pesticide residues in fish from Maine, Vermont, and New Hampshire, taken from lakes where pesticides have never been used on the watershed (Haines, 1981).

Direct Health Effects

While acid precipitation is associated with the indirect health effects discussed above, medical authorities doubt that acid precipitation *per se* has any important direct effects on human health (Interagency Task Force on Acid Precipitation, 1981). However, the fine particles associated with atmospheric deposition in general are a health concern and much data is available to support this conclusion.

Early concern for health effects of air pollution focused on SO_2 and particulates, but more recent evidence has indicated that the transformation products of SO_2, principally various sulfates, are more likely to be responsible for many of the adverse health effects previously associated with SO_2. These include increased attack frequency in asthmatics, worsened symptoms in cardiopulmonary patients, decreased ventilatory function in school children, and acute and chronic respiratory diseases in both children and adults (EPA, 1975). Laboratory studies conducted on animals by Amdur (1959, 1969) and Alarie (1973) have revealed that adverse biological responses occur at far lower concentrations of sulfuric acid and particulate sulfate than for sulfur dioxide.

Having identified sulfates as a potentially harmful pollutant, numerous investigators have documented a positive correlation between ambient sulfate and morbidity, the relative incidence of disease (Chess, 1974; EPA, 1975; Rall, 1974; American Lung Association, 1976; Finklea, 1974; Dohan, et al., 1962. Results from many of these studies were summarized in a 1975 EPA

"Position Paper on Regulation of Atmospheric Sulfates" (See Table 5). Please note that in Table 5, adverse health effects of sulfates were noted at ambient concentrations comparable to the levels found on an annual basis throughout the Northeast.

Other studies support the concern for the health effects of sulfates. In work supported by the U.S. Department of Energy, an extensive literature search on the subject of the health effects of ambient sulfates provides compelling evidence of the health dangers from fine sulfate particulates (Hamilton, 1979). Lave and Seskin (1977) noted a strong statistical association between atmospheric sulfates and cancer mortality, cardiovascular mortality, infant mortality and total mortality. They estimated that a 10% decrease in both sulfates and particulates would result in a .9% decrease in total mortality.

The health effects for sulfates are related to the small size of sulfate particles, which when inhaled are carried well down into the respiratory system.

Experimental, short term exposure of humans and animals to acid sulfate aerosols has led to persistent disturbance in bronchial muco-ciliary clearance. Such interference with the defense mechanism of the respiratory system has been clearly linked with chronic bronchitis. The data indicate that acid sulfate inhalation is a causal agent of chronic bronchitis and is perhaps the associated morbidity and excess mortality noted in numerous epidemiological studies (Lippman, et al., 1980).

The presence of other substances along with sulfates increases their potential harm. Fossil fuel combustion in power plants, the main source of SO_2 and sulfates, is also the source of a variety of other toxic air pollutants including polycyclic aromatic hydrocarbons (PAH) and trace elements such as lead, mercury, beryllium, cadmium, and arsenic. These other pollutants are

Table 5. RESULTS OF EPIDEMIOLOGICAL STUDIES

	Concentration[a] at which effect was observed		
Adverse health effect	SO_2, µg/m^3 (ppm)	Sulfates, µg/m^3	Averaging time
Increased mortality	300-400 (0.11-0.15)	NA[b]	24 hr
Aggravation of symptoms in elderly	365 (0.14)	8-10	24 hr
Aggravation of asthma	180-250 (0.07-0.09)	6-10	24 hr
Decreased lung function in children	220 (0.075)	11	Annual mean
Increased acute lower respiratory disease in families	90-100 (0.034-0.037)	9	Annual mean
Increased prevalence of chronic bronchitis	95 (0.035)	14	Annual mean
Increased acute respiratory disease in families	106 (0.039)	15	Annual mean
Increased respiratory disease related illness absences in female workers	NA[b]	13	Annual mean
Primary standard	365	-	24 hr
Primary standard	80	-	Annual mean

[a] Effects levels are best judgment estimates based on a synthesis of several studies.

[b] NA = not available.

Source: EPA (1975). "Position Paper on Regulation of Atmospheric Sulfates", EPA-450/2-75-007, Office of Air Quality Planning and Standards.

emitted as gases due to the high combustion temperatures and can be absorbed or condensed onto fine particulates and inhaled (Perera and Ahmed, 1979). Since the acid sulfates decrease the efficiency of the respiratory clearance mechanism (Lippman, et al., 1980), the accompanying toxic substances remain in the lungs longer and are more likely to be absorbed.

As a final point, several major studies have associated sulfate with mortality to draw the following conclusions:

- At least 50,000 premature deaths nationwide are attributable to air pollution from sulfur emissions and related transformation products (Wilson, et al., 1980).

- Myers and Hamilton (1978) of Brookhaven Laboratories have developed what they regard as a reasonably accurate human damage equation whereby each $\mu g/m^3$ of sulfur particulate matter was associated with 3.7 excess deaths per 100,000 population per year. Usingt this formula, they estimated that atmospheric sulfate was associated with 21,000 premature deaths per year, east of the Mississippi River.

- According to a nationwide statistical analysis of over 2 million death certificates filed in 1970, sulfate was associated with 187,686 deaths per year (150,000 deaths per year if estimates are lowered two standard deviations) among the white adult population of the U.S. (Mendelsohn and Orcutt, 1979).

- In at least two studies which link sulfate with mortality. the dose-response curves developed for sulfate appear to be linear, which indicates that there is no minimum "safe" level of sulfate below which human health will not be adversely affected (Mendelsohn and Orcutt, 1979; Lave and Seskin, 1977).

- The probability of dying from air pollution in the north central and northeastern regions of the U.S. is about twice as high as in the rest of the country (Mendelsohn and Orcutt, 1979).

Summary

The long range transport and atmospheric deposition of air pollutants are endangering human health and welfare in the Northeast, both indirectly and directly. Drinking water quality has been impaired by acid loadings which necessitate more treatment to reduce corrosivity and avoid the leaching of lead, copper, and other metals from distribution systems. Some metals, such as aluminum, have been leached into surface and groundwater supplies, and may have dire consequences for kidney dialysis patients if dialysate water is not adequately treated. Other metals and toxic organics deposited into lakes and ponds following long range transport have accumulated in fish tissue and have rendered the fish dangerous for human consumption.

Extensive data confirm that sulfates and other fine particles involved in atmospheric deposition are associated with direct effects on human health, from serious respiratory and cardiovascular diseases to death from cancer. Adverse health effects have been identified at levels well below the annual sulfate levels found in the Northeast, sulfate levels that are attributable in large part to long range transport into the region. The high levels of sulfates in the Northeast definitely contribute to a significant number of premature deaths, and the probability of dying from air pollution-related diseases is significantly higher in the Northeast.

SUMMARY AND CONCLUSIONS

The Northeast is subject to long range atmospheric transport, and receives considerable levels of air pollutants from outside the region. The deposition of these pollutants has complex and far reaching consequences. Information on long range transport, deposition, and the subsequent damage to the Northeast that is presented in this report supports the following conclusions:

Long Range Transport and Atmospheric Deposition

The pollutants involved in atmospheric transport include sulfates and nitrates (the primary components of acid rain), heavy metals, and toxic organics, all of which are subject to long range transport because of their existence as fine particles. These pollutants are finally removed from the atmosphere and deposited on land and water by a variety of well known mechanisms.

SO_2, the primary precursor to acid (sulfate) deposition, is emitted in significantly larger amounts by midwestern power plants, compared to emissions from states in the Northeast.

Prevailing wind patterns subject the Northeast to transported pollutants year round. In the summer, well documented meteorological patterns bring especially high levels of sulfate and other pollutants into the Northeast from the Midwest, and interfere with the Northeast States' ability to meet mandated air quality goals. Measurements of wet and dry deposition throughout the Northeast show that high sulfate and low pH values are consistent from year to year, and are not the result of unusual precipitation patterns in any one season.

Because of the complex nature of atmospheric transport transformation, and deposition, mathematical models are necessary to simplify the assessment of damage and evaluation of control strategies. While considerable differences exist between model results, the models developed by Pacific Northwest Laboratory and Fay and Rosenzweig are found to be more accurate representations of transport in the Northeast U.S. than the EURMAP model, the results of which have been widely quoted by EPA.

Regional Impacts of Atmospheric Deposition

Both wet and dry deposition of air pollutants such as sulfate, nitrate, metals, and toxic organics impact the environment, and human health and welfare in the Northeast.

Much of the Northeast is especially vulnerable to acid precipitation due to sensitive soils and waters with naturally low buffering capacity. Lakes, streams, and reservoirs in the region tend to be very low in alkalinity and this vulnerability to acid input is widespread.

Increases in acidity, the leaching of aluminum, and the deposition of Pb and Cd are all associated with loss of fish in Northeast waters. Increasing acidity from precipitation is also interfering with reproduction of both fish and amphibians across the Northeast; water supplies may require increased treatment to reduce corrosion.

Terrestrial as well as aquatic ecosystems are affected. Some metals such as Pb are accumulating in Northeast soils from long range transport and atmospheric deposition. Other metals and some nutrients are being leached by acid precipitation. High altitude forest production in some areas has decreased over the past 14 years.

Manmade structures are not exempt from the impact of atmospheric deposition. Buildings and monuments of stone, masonry, and metal are deteriorating at an accelerated pace due to wet and dry deposition of acid and particulate pollutants.

Visibility is being reduced, especially during summer months, most damaging for the Northeast tourist industry. Light dispersion, due to atmospheric sulfate, also limits available sunlight for solar energy production, plant photosynthesis, and may have other climatological effects.

Human health and welfare are affected indirectly from contaminated fish and drinking water supplies. Drinking water quality is lowered by increased acidity and corrosiveness, as well as increases in metal content from soil leaching and atmospheric deposition. Accumulation in fish of metals and toxic organics from long range transport and deposition in some lakes across the Northeast render the fish unfit for human consumption.

Human health is also directly impacted by sulfates and other fine particles transported in the atmosphere. Impacts range from serious respiratory and cardiovascular diseases to death from cancer. High levels of sulfate in the Northeast, largely due to long range transport into the region, contribute significantly to morbidity in the region. The probability of dying from air pollution-related diseases is twice as high in the Northeast than in other regions of the United States.

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-STATEMENT OF MAURICE. D. ARNOLD BEFORE THE U.S. SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS, Randolph, Vermont, June 30, 1981

I am Maurice D. Arnold, land management consultant, of Whiting, Vermont. I am also a member of the Vermont House of Representatives, serving on the Natural Resources Committee.

I draw your attention to J.R.H. 28, now engrossed as R-58, a joint resolution of the 1981 adjourned session of the General Assembly.

It recognizes the importance of clean air to Vermont's tourist, agricultural and forest industries, and calls on the State's delegation in Congress to lead in improving the Clean Air Act during the current reauthorization process.

We are concerned especially about the long distance transport of pollutants, particularly those causing acid precipitation.

Although the evidence is skimpy, I believe acid precipitation is a threat to the productivity of land and waters. It is an external cost of current methods of burning coal; unless these are changed, there may be vast sacrifice areas in northeastern U.S. and in Canada. We ought to try to prevent this, as correction may be even more costly.

You face serious obstacles in dealing with this issue. In areas supplying much of the particulates and other matter causing the problem, coal suppliers are fearful of losing markets. Many of the utilities are in severe financial straits, and internalizing this external cost may drive some to bankruptcy. Many businessmen perceive the Act as a threat to continued profitability, and many of them are under siege from stockholders for some poor strategic decisions in the past. And many people feel more evidence needs to be collected.

The problem may be like that of the fisheries: strong evidence may not come in until the resource is in extremely rapid decline.

Solutions may lie in use of the current fuel subsidies given private industry for coal treatment or for better stack controls, in highly selective, cost efficient reductions of emissions in some stacks in the Ohio Basin and other "bubbles," and in allowing greater opportunity for injured states to collect damages when these can be proven and traced. These are, of course, in addition to proven concepts for reductions of harmful emissions.

I wish you strength, wisdom and success in your deliberations, and support strengthening the interstate provisions of the Act. The other provisions may be "fine tuned," but not weakened.

Attached: R-58, Joint Resolution Relating to the Clean Air Act.

C O P Y R-58

J.R.H. 28 - Joint Resolution Relating to the Clean Air Act

Offered by: The House Natural Resources Committee

Whereas, the Clean Air Act is the cornerstone of our national air pollution control program and federal, state and local pollution control programs established under the Clean Air Act have resulted in significant reductions in major pollutants, and

Whereas, the entire population of Vermont is frequently exposed to concentrations of atmospheric sulfate in excess of concentrations for which adverse health effects have been demonstrated, although Vermont emits the smallest amount of sulfur dioxide of any state in the country, and

Whereas, there is evidence that acid precipitation has adverse effects on drinking water, soils, forests, fish and wildlife, and

Whereas, concentrations of atmospheric pollutants can result in significant reductions in visibility throughout the state of Vermont, particularly during the summer season when travel and outdoor recreation is heaviest, and

Whereas, Vermont is susceptible to severe damage from acid precipitation carried by winds from other states, nowtherefore be it

RESOLVED BY THE SENATE AND HOUSE OF REPRESENTATIVES

That inasmuch as the State of Vermont bears the damages associated with national emissions of sulfur dioxide and other air pollutants to a degree out of proportion to Vermont's contribution to the problem and Vermonters recognize the importance to the State's tourist, agricultural and forestry industries of maintaining clean air, members of the Vermont Congressional Delegation are, during the current reauthorization of the Clean Air Act, urged to play a leadership role in improving the operation of the Act, especially as it relates to the control of long range transport of sulfates and other pollutants, so that the Act continues to protect human health and preserves the public's right to breathe clean air and enjoy the other benefits of an unpolluted atmosphere, and be it further

Resolved: That the Secretary of State send copies of this resolution to Vermont's Congressional Delegation, the Minister of Environment, Ottawa, Canada, and the Speaker of the House of the New York General Assembly.

/s/ Stephan A. Morse
Speaker of the House of Representatives

/s/ Madelene M. Kunin
President of the Senate

Attested to:

/s/ Robert L. Picher
Clerk of the House of Representatives

VERMONT NATURAL RESOURCES
COUNCIL

TESTIMONY OF SEWARD WEBER BEFORE THE
U. S. SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
RANDOLPH, VERMONT, JUNE 30, 1981

Introduction

My name is Seward Weber. I am the executive director of the Vermont Natural Resources Council, an environmental education organization dedicated to understanding the environmental and ecological realities and helping others understand the relationship between them and the economic and social systems by which people live.

I am also representing, along with Peg Bowen, the Vermont Clean Air Coalition which includes, besides VNRC, the Vermont Lung Association, the Lake Champlain Committee, the Winooski Chapter of Trout Unlimited, the Vermont Public Interest Research Group, the Vermont Sierra Club, the Vermont Chapter of Friends of the Earth, and the Vermont Audubon Council.

I should like to limit my contributions today to a brief discussion of:

1. the environmental impacts of air pollution,
2. the effects of these on the economic and social welfare of the state,

3. an innumeration of recommendations for changing the Clean Air Act.

Environmental Impacts of Air Pollution

The Vermont landscape and that of New England as well as northeastern North America is under stress from years of man-made air pollution. It varies, of course, with location, being more serious in industrialized southern New England, New York and New Jersey but northern New England and the eastern provinces of Canada are by no means immune to it. Vermont has only relatively recently become fully aware of the long-range transport problem and the degree to which Vermonters are being victimized by it.

Attempts to obtain cheap energy or at least slow the growth of energy costs carry with them the danger of increasing air pollution by encouraging increased reliance on relatively abundant coal. But if in our haste to ameliorate the immediate energy supply short-fall we do not adequately account for the long-run dangers to the environment, we will have won a Pyrrhic victory.

The landscape is a living system made up of innumerable subsystems depending on solar energy to perform an array of natural functions basic to the welfare of man and society. These include the usual multiple use functions which give us much pleasure and add meaning to our lives while at the same time producing a variety of essential products such as wood and the ingredients of medicines.

But the landscape also plays a critical role in providing for our welfare by regulating the hydrologic, biogeochemical and erosion cycles and moderating local climate. These cycles are all operated on solar energy and they are free but they don't happen in isolation of the landscape. They operate on and through the landscape and the atmosphere.

The ecosystems must carry on functions to sustain and enhance themselves in the face of destabilizing forces that could diminish or destroy them. The net result is a stability provided it is not upset by human activities. Of course, human intervention is intensifying with population growth and our craving for a high material standard of living. That is not necessarily bad. It just may in the long-run be counter-productive.

In any event, man-induced pollution of air and water causes ecosystems to lose their capacity to maintain the stability of the landscape--that is, to moderate climate, filter air and water, recharge groundwater and to control erosion. When natural systems which provide the conditions necessary for a productive, habitable and enjoyable environment break down, the need arises to develop artifical means of accomplishing the same thing. It is my belief that even if we could artifically sustain in space-age fashion a chronically ill natural environment, we could never afford to do it.

Measurement of damage to the landscape is difficult because of the complexity of the natural systems and the fact that very little base-line data exists against which change can be gauged. Nevertheless, as Professor F. H. Bormann of Yale University points out in a recently prepared paper, "large scale genetic, biological, and ecosystem changes are probably occuring under current levels of air pollution stress. Since the effects of air pollution on ecosystems are mostly indirect and cumulative, such as a reduction in the reproductive capacity of a key species or the progressive loss of fertility in forests or alkalinity of lakes, there is a legitimate concern that in a few decades, vulnerable forest, lake, and stream ecosystems may simply fall apart."

Bormann describes in his paper three levels or stages of pollution stress that can lead to ecosystem collapse. Stage I is minor and does not produce species or ecosystem malfunctioning. In the more advanced condition of stage II some plant species will die out for the most part, usually succumbing to some secondary cause such as fungal or insect attack. There are repercussions, of course. In stage III with increased pollution stress trees and other large plants die off and the structure of the forest ecosystem changes dramatically. Productivity is greatly reduced and the ability of the ecosystem to regulate biogeochemical cycles is diminished. The final throes of stage III is ecosystem collapse from which recovery can be a very long-term affair.

Bormann believes that there is evidence that some parts of New England are in stage I while "considerable area is probably well advanced into stages IIA and IIB..." He says that stage III conditions are rare in the northeast but that they can be seen in localized situations adjacent to smelters in Canada, Connecticut and Pennsylvania.

Professor Bormann is not claiming that "the sky is falling" but he is saying, and supporting it with research findings on sensitive species, the potential effects of acid rain, growth response of some tree populations and productivity responses to air pollution, that current levels of air pollution have the potential to seriously damage the landscape of the northeastern United States and adjacent Canada.

Implications for Vermont's Economy

Vermont, more than industrialized states, has a close linkage between its principal economic sectors and its environment. Agriculture, forest products, tourism and recreation, quarrying, and even manufacturing, to the extent that plants are located here because of quality-of-life factors, are directly dependent on the ambiance of the landscape. If our landscape suffers, so do our people not only through the direct health effects of air pollution but indirectly through loss of jobs and livelihood. If acid deposition, for example, decimates our sport fishing industry, the loss to the state's economy will be up to 75 million dollars.* If in time the Green Mountains lose much of their vegetative cover, not only will our wood products industry be deprived of a substantial source of raw material but the state's ability to attract tourists would be substantially effected.

These possibilities are not outlandish. If they occur, it will not be because Vermonters have fouled their own nest. It will happen because we have been victimized by the long-range transport of air pollutants from up-wind.

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*According to Alphonse Gilbert, Resource Economic Department, University of Vermont.

Vermont's future lies down the road not taken by most of our neighboring states to the south. Our natural heritage, geographic location and the accidents of history have placed us apart from the industrialized northeast and we cannot, nor should we aspire to, become a New Jersey, eastern Massachusetts or even southern New Hampshire. Our future lies with the cultivation and improvement of our rural landscape and the economic activities which have historically drawn sustenance from it. Our environment provides the raw material for those activities. The air is part of that raw material base and if it is not kept clean it may become the agent of our economic and social destruction.

Recommendations

The Vermont Clean Air Coalition and the Vermont Natural Resources Council believe that the Clean Air Act should be strengthened. As I have tried to point out, the danger to the environment of continued air pollution stress at the present level of intensity is viewed by environmental scientists as significant if present conditions are allowed to persist or become aggravated. While it is not a question of our hillsides turning brown tomorrow or next year, the northeast could face extraordinary environmental problems two or three decades from now at which time it would be difficult if not impossible to react effectively.

We believe that attempts to weaken the Act are misguided and should be resisted. The Act should:

o retain prevention of significant deterioration (PSD) provisions

- retain automobile emission standards and deadlines
- retain the current method of establishing national ambient air quality standards to protect sensitive populations with a margin of safety and without the application of cost-benefit considerations
- retain deadlines for attaining ambient air quality standards
- retain offset requirements and lowest achievable emission rates for new sources in non-attainment areas
- retain the current no-credit-for-tall-stacks policy

Finally, the following improvements should be made to the Act:

- reduce sulfur dioxide and nitrogen oxides emissions from poorly controlled existing stationary sources to bring acid deposition under control
- repeal the special exemption for the smelter industry
- mandate energy conservation practices so as to reduce the need for increased electrical generating capacity and consumption of fossil fuels for space heating
- add fine particulate matter to the list of criteria pollutants and establish standards for it that are more stringent than those of total suspended particulates
- place a moratorium on relaxations of State Implementation Plans granted by EPA
- create a workable mechanism by which states adversely affected by poorly controlled up-wind sources can seek relief.

We believe that these are necessary in order to reduce air pollution induced stress on the natural environment of New England and Vermont.

The prudent course is one of prevention and stewardship, not one of crisis intervention ten or twenty years from now when it may be too late to reverse ecosystem deterioration or collapse.

TESTIMONY OF JANINE WURSTER BEFORE THE SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS. RANDOLPH, VT. 30 JUNE 1981

As a four year resident of Vermont, I am deeply concerned about the quality of the air we breathe in this state. Most Vermonters probably believe their air is relatively clean and safe. This, unfortunately, is not the case. Our air is threatened by sources we have no control over, namely power plant and industry emissions from the midwest Ohio River valley. The very fact that Vermont emits the lowest measure of sulfur dioxide pollution east of the Mississippi and experiences the highest concentration of sulfates in the summer when our own emissions are at a minimum, is proof enough that we are dealing with an inter-state problem.

The long range transport of pollutants is poisoning our environment and damaging our health. Because air pollution fails to heed state boundaries, federal laws are needed to deal with the problem. In its present form, the Clean Air Act does not adequately deal with the long range transport situation. The Act must be strengthened and provisions added to further protect the health of the public. A major issue we are dealing with during this reauthorization process is that of public health versus industry profit.....which comes first?

The Council on Environmental Quality has estimated over 140,000 lives were saved in 1978 as a result of air quality improvements made since 1970 when the Clean Air Act was passed. Vermont's air quality is aresult of the Clean Air Act's regulations and its Program for Prevention of Significant Deterioration. This program is designed to protect those areas, such as Vermont, presently meeting air quality standards.

The Clean Air Act regulations must not be weakened as the Reagan administration draft amendments and the Broyhill bill propose. These amendments legalize air pollution. Under the Administration draft amendments, Vermont's air quality would be allowed to deteriorate to a level of significant health risks before anything would be done.

Air pollution is a recognized human health hazard. Through the national ambient air quality standards, the Clean Air Act currently protects those members of the population least able to participate in the standard setting: the young, the ill, and the elderly. Regulations now based on primary health standards should be retained without the cost/benefit considerations industry is pushing for. Air pollution is a factor in the three major diseases which have become our greatest killers: heart disease, cancer, and lung disease. The cost/benefit approach trys to put a price tag on human health - something which is priceless. We must place public health over industry finances.

Several provisions need to be added to the Act during this reauthorization process. Currently the Total Suspended Particle Standards fail to account seperately for fine particulate pollution. It is these fine particulates (under 25 microns) which cause the greatest damage to the human respitory system because they are inhaled the deepest into the lungs. Fine particulate and sulfate pollution must be added to the list of criteria pollutants. This action will help control the source of our acid rain problems by bringing the long range transport problem to public attention and initiating national regulation at the source.

EPA has also determined standards for only four toxic air pollutants thus far, even though hundreds of others are found in urban air. Action is needed to be taken to speed the EPA's setting of emission limits and issuance of standards for more hazardous substances.

A major concern for Vermont is the Act's ability to deal with the long range transport problem. Our state incurs enormous costs due to acid rain. Damage includes the poisoning of our lakes, the decreased productivity of our soils due to leaching, costs to our tourist industry due to decreased visibility, the deterioration of our buildings and monuments, and harm to our health. The Clean Air Act must include standards for acid rain causing pollutants from existing power plants, as well as new ones. National standards are needed to prevent industries from "shopping around", locating in areas with low ambient air quality standards, and creating pollution which harms Vermont but from whose source Vermont receives no benefit. Vermonters need a federal regulatory program to help control acid rain, and the best mechanism for this is the Clean Air Act.

Industry arguments are based on the cost of pollution control. They fail to take into account, however, the fact that air pollution is destructive to farm and alpine vegetation, the surfaces of buildings, and human health. We cannot sit back and wait for conclusive scientific evidence. Pollution control technology exists now and must be used to prevent further damage. Scientific evidence is even scarcer concerning the recovery of the natural ecosystem after pollution damage has occured.

It is important to realize that the voting public is for clean air! Cost is the only basis for attempts to weaken the Act, however, the cost to society of cleaning up the air and keeping it clean is outweighed by the economic and human benefits. The cost to certain segments of society which have not as yet taken responsibility for the clean disposal of their waste products should not deter Congress from retaining the Clean Air Act in its present, or in a stronger, form.

Senator Stafford, we support you in your fight for clean air and public health.

VERMONT ACID PRECIPITATION LAKE MONITORING PROGRAM

1980

by

Brian D. Kooiker

ACKNOWLEDGEMENTS

Many people within the Water Quality Division of the Vermont Department of Water Resources and Environmental Engineering have contributed directly or indirectly in the planning, sample collection and water quality analysis stages of this study.

Special acknowledgement is given to Jim Kellogg, who was primarily responsible for sample collection and data compilation and to Dr. Carl Pagel for his work in planning various stages of this study. Thanks is also due to the Department of Water Resources and Environmental Engineering Laboratory staff for their help and expertise in completing the water quality analysis.

Finally, thanks is given to Wallace McLean, Brenda Clarkson, Eric Smeltzer and Dr. Carl Pagel for their ideas, criticisms and suggestions on this report.

INTRODUCTION

Acid precipitation in the northeastern United States and its accompanying effects on aquatic ecosystems is a well documented occurrence.[1,2,3,4] The pH of precipitation in this region is now approximately 4.1.[1] Significant reductions in the pH of Adirondack Lakes of New York State and the resulting loss of fish populations in these waters has also been substantiated.[4] Confirmation of similar trends in Vermont has not been possible due to lack of reliable historical data. In order to obtain an accurate data base, The Vermont Department of Water Resources and Environmental Engineering conducted a survey of 121 lakes during February and March 1980. The results of this survey delineated those geographical areas encompassing lakes sensitive to inputs of acid precipitation.[5] This survey also pointed out the importance of acquiring long-term surface water and precipitation data in order to determine the effects of acid precipitation. Based on the results of this survey, the Department established the present program of long-term monitoring (ten years) of twenty-five Vermont lakes. The following report is a summary of the study on these twenty-five lakes during 1980.

SUMMARY AND CONCLUSIONS

1) Interpretation of lake sensitivy based on the calcite saturation index should be based on several data points given the seasonal variability of the data. This is particularly important for lakes with CSI values bordering the designated categories.

2) pH fluctuations above and below critical levels have been observed and can be expected to have an impact on sensitive aquatic species.

3) Present data indicates that the most sensitive Vermont lakes are located in the southern Green Mountains and/or at elevations above 2000 feet.

4) Qualitative comparison of 25 Vermont lakes with unimpacted areas shows a reduction in alkalinity for all these lakes and a significant reduction in pH for the most sensitive lakes.

5) Quantitative estimates of alkalinity reductions for the 25 long-term monitoring lakes are in the order of 5 mg/1.

6) The number of lakes exhibiting zero alkalinity and a pH of 5.5 and below will continue to escalate over the next several decades resulting in significant alterations of the aquatic biological communities.

METHODS

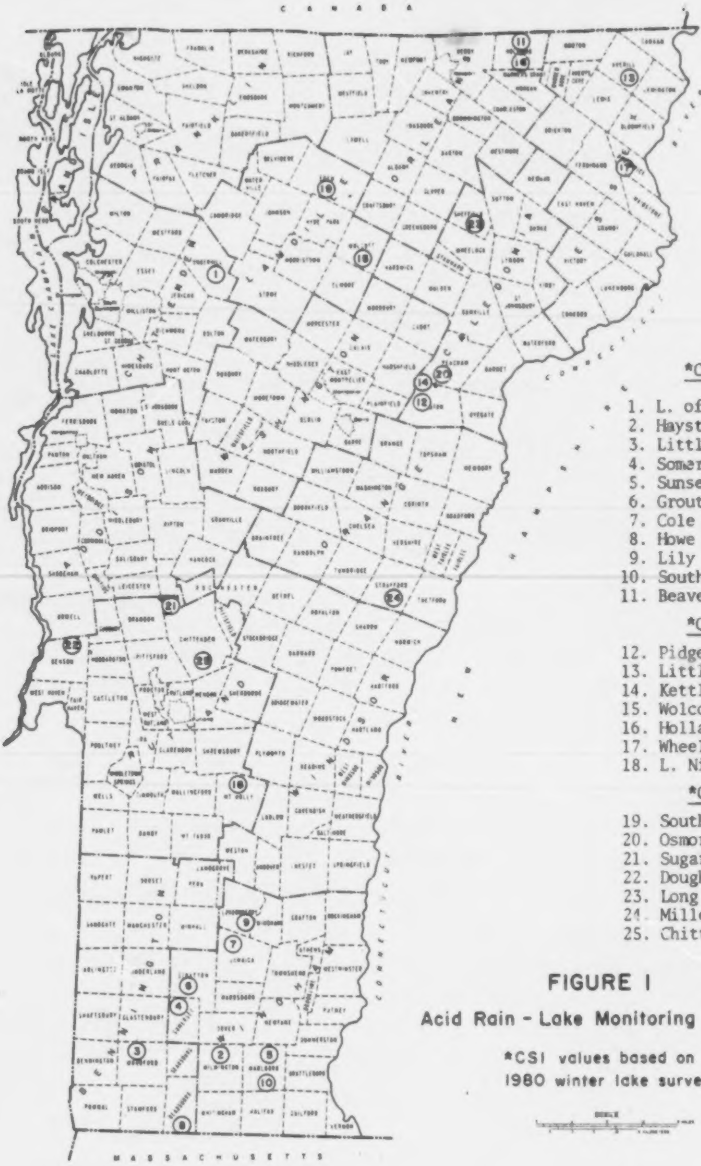
Lake Selection

Selection of lakes for inclusion in the long-term monitoring program was based on three primary factors: 1) sensitivity to acid inputs, 2) influence of human activity in the watershed, and 3) geographical location (See Figure 1). Sensitivity to acid inputs was determined by the calcite saturation index (CSI) which is derived from pH, calcium and alkalinity measurements (Equation 1).[5,6,7]

$$(1).\quad CSI = \log_{10} \frac{(Ca\ mg/l)}{40{,}000} - \log_{10} \frac{(Alk,\ mg/l)}{50{,}000} - pH + 2$$

These three parameters are critical factors in the natural buffering systems of surface waters and therefore are critical with respect to a lake's ability to resist changes in pH. For the purpose of selecting lakes for long-term monitoring, CSI values were divided into three categories, with increasing CSI values denoting increasing sensitivity to acid inputs. CSI values greater than 4 denoted lakes that are unstable, relative to acid loadings. CSI values between 3 and 4 indicate lakes with some unstability relative to acid loadings and lakes with CSI values in the range of 2-3 are generally stable relative to acid loadings. Lakes with CSI values less than 2 were not selected for long-term monitoring due to their high resistance to pH changes over relatively long periods of time.

Influence of human activity was interpreted to mean, minimal shoreline development by permanent and seasonal residences, minimum of agricultural activities and lack of contamination from sewage, road salt (chloride) and other pollutants. Lakes were also selected to represent each geographical area which had been


CANADA
MASSACHUSETTS
NEW YORK
NEW HAMPSHIRE
CONNECTICUT RIVER
LAKE CHAMPLAIN

*CSI 4

1. L. of the Clouds
2. Haystack Pd.
3. Little Pd.
4. Somerset Res.
5. Sunset L.
6. Grout Pd.
7. Cole Pd.
8. Howe Pd.
9. Lily Pd.
10. South Pd. (Marlboro)
11. Beaver Pd.

*CSI-3-4

12. Pidgeon Pd.
13. Little Averill L.
14. Kettle Pd.
15. Wolcott Pd.
16. Holland Pd.
17. Wheeler Pd.
18. L. Ninevah

*CSI 2-3

19. South Pd. (Eden)
20. Osmore Pd.
21. Sugar Hill Res.
22. Doughty Pd.
23. Long Pd.
24. Miller Pd.
25. Chittenden Res.

FIGURE I

Acid Rain - Lake Monitoring Program

*CSI values based on
1980 winter lake survey

previously identified as susceptible to acid precipitation.[5] Lake of the Clouds, near the summit of Mt. Mansfield, was added during the summer of 1980 due to the unique topography of its location and its suspected heavy acid loading.

Sampling Frequency and Methodology

The majority of lakes were sampled five times during 1980 (February-March, June,July, August, October) for pH, alkalinity, calcium (Ca), magnesium (Mg) and conductivity. Samples for sulfate (SO_4) and chloride (Cl) analyses were collected on four sampling dates (June, July, August, October). Limited monitoring of the biological communities was undertaken on two of the twenty-five lakes (Beaver Pond and Sunset Lake) including analysis of chlorophyll-a concentrations and examination of phytoplankton, zooplankton and benthic communities.

Sampling was more frequent during the summer months due to the projected high variability of all parameters at this time resulting from increased biological activity. An additional spring sampling date (April-May) is scheduled for the remainder of the study period (1981-1989). Samples were collected with the aid of a canoe in most cases, however lakes with more difficult access were sampled by means of a float tube device. An attempt was made to obtain pelagic samples from all lakes. Due to access difficulties and equipment shortages at the beginning of the summer, this was not possible for every lake and littoral samples were taken as an alternative in those cases. Samples for physical and chemical analysis were vertically composited by means of a five meter length of 5/8" I.D. Tygon tubing.[8] At those sampling stations with a depth of less than two meters surface grab samples were taken. Samples were composited in a one liter polyethylene bottle and proportioned into separate containers for individual analysis.

Chlorophyll-a and phytoplankton samples were also collected with the Tygon tubing. Zooplankton samples were taken by means of a vertical haul with a Wisconsin style plankton net and benthic organisms were collected with an Ekman dredge.

Preservation and Analytical Procedures

Preservation of Ca and Mg samples was accomplished with 2 mg/l concentrated nitric acid. Two of the seven physical and chemical parameters, pH and alkalinity, were analyzed in the field due to their limited holding times. pH was measured within twelve hours using a Cole-Parmer Digi-pH-ase pH meter and a Cole-Parmer combination (Ag/Ag/Cl reference) glass body electrode. Prior to pH measurement the meter was standardized via the two point (pH 4 and 7) calibration procedure.[9] The low level potentiometric titration method was employed for alkalinity determinations.[9] Samples were titrated with 0.01N H_2SO_4, using a magnetic stirrer to insure adequate mixing after acid additions. Sample volumes were varied based on the known range of alkalinity for a particular lake. Alkalinity analyses were performed within 24 hours of collection.

The remaining five parameters (Ca, Mg, SO_4, Cl, conductivity) were analyzed at the Department of Water Resources and Environmental Engineering laboratory in Montpelier. Calcium and magnesium concentrations were determined with a Perkin-Elmer Model 305B atomic absorption spectrophotometer. Samples were aspirated directly without digestion and lanthanum was added to negate possible interference.[9] Sulfate determinations were performed by the authomated methylthymol blue method using a Technicon Auto Analyzer II system.[10] Chlorides were analyzed by the automated ferricyanide method.[10] Specific conductance was measured with a Lab-Line MHO meter (Model MC-1, Mark IV). Conductivity analysis were completed within four days of sample collection. Chlorophyll-a measurements were made with a Turner filter fluorometer (Model III), corrected for pheophytin-a.[11] $MgCO_3$ was added as a buffering agent. Samples were filtered (.45 micron membrane filter) the day of collection and frozen until the time of analyses. All analyses for chlorophyll-a were completed within thirty days of the day of collection.

Processing of phytoplankton, zooplankton and benthic samples has not yet been completed. These organisms will be keyed to the taxonomic levels that define known acid sensitive and acid tolerant groups.

RESULTS AND DISCUSSIONS

The main objective of the acid precipitation lake monitoring program is to determine the long-term trends of certain physical, chemical, and biological parameters. It is clear that no such trends can be discerned within a one-year time period. However 1980 data (Table 1) does more clearly define present day conditions and can be utilized to estimate previous changes.

Variation in CSI and pH Data

The February-March, 1980 survey of Vermont lakes attempted to assess the sensitivity of these lakes based on a single observation. Questions concerning the seasonal variations of this data base were noted in the report detailing this study.[5] The variation of CSI is of particular concern since it was the primary factor used to assess sensitivity to acid inputs. Figure 2 demonstrates that for a specific lake, CSI values may vary seasonally between the different CSI categories. Consequently, the number of lakes falling into any of the three CSI categories will also vary depending on the time of year. Pigeon Pond, for example, (mean CSI 3.36) exhibited CSI values ranging from unstable (CSI 4) to generally stable (CSI 3). Conversely, two lakes with mean CSI values similar to Pigeon Pond, Little Averill Lake and Wolcott Pond (3.16 and 3.37, respectively), showed relatively small variation during the same time period.

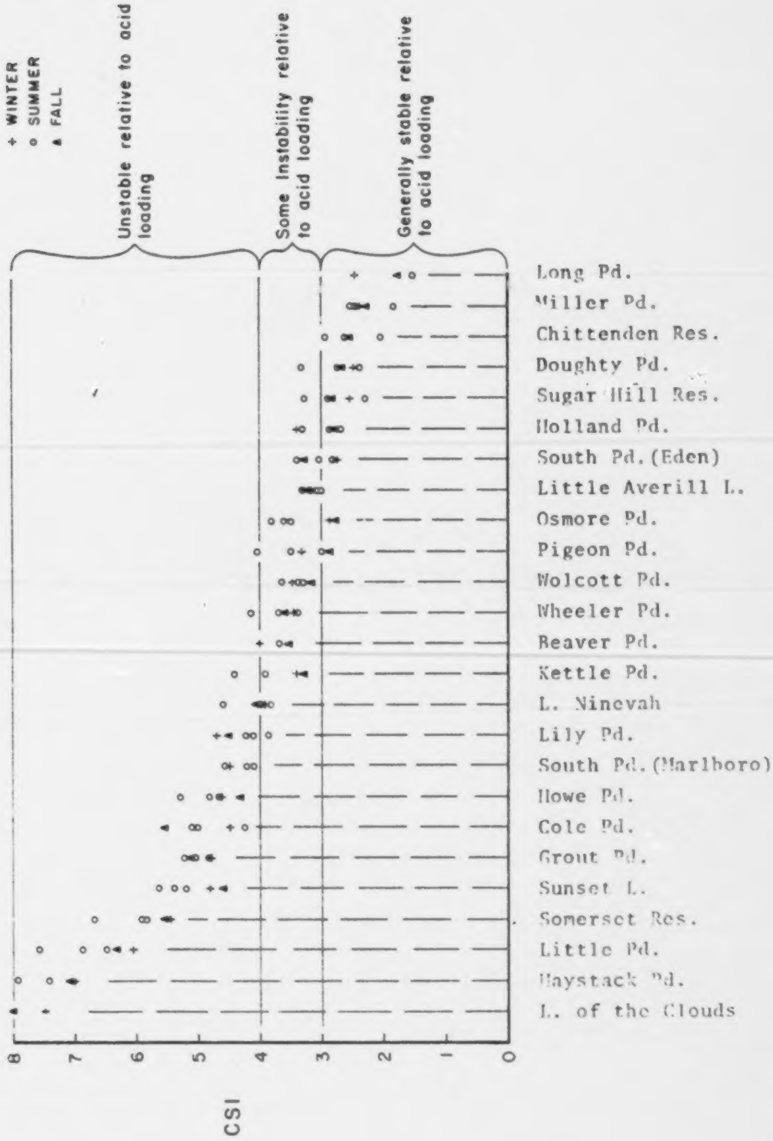
Table 1. 1980 Annual Lake Means - Chemical and Physical Data - Acid Precipitation Lake Monitoring Program*

	pH	Alk mg/1	Ca mg/1	Mg mg/1	SO4 mg/1	Cl mg/1	Cond µomhs/cm	CSI	Elev ft
Beaver Pd. (Holland)	6.49	3.3	3.62	0.44	5.69	0.50	26	3.74	1535
Chittenden Res. (Chittenden)	6.94	14.5	4.76	1.31	6.35	1.00	44	2.53	1495
Cole Pd. (Jamaica)	5.96	1.8	1.91	0.64	5.81	1.35	24	4.87	1193
Doughty Pd. (Benson)	6.60	17.0	5.79	1.73	7.58	0.77	46	2.73	631
Grout Pd. (Stratton)	5.95	1.4	1.70	0.44	4.60	0.56	17	5.00	2225
Haystack Pd. (Wilmington)	4.58	0.2	.94	0.26	4.47	0.46	16	7.45	2984
Holland Pd. (Holland)	6.84	6.0	4.51	0.58	6.50	0.56	30	3.04	1430
Howe Pd. (Readsboro)	5.92	2.1	2.17	0.48	5.74	0.72	19	4.74	1926
Kettle Pd. (Groton)	6.31	4.8	3.56	0.52	6.50	0.56	31	3.77	1443
L. of the Clouds (Cambridge)	4.25	0.2	1.46	0.34	8.27	0.42	31	7.74	3950
Lily Pd. (Londonderry)	6.08	3.7	2.45	0.84	5.72	0.62	24	4.28	1490
Little Pd. (Woodford)	5.08	0.3	1.46	0.38	6.34	0.70	19	6.65	2602
Little Averill L. (Averill)	6.87	6.0	3.23	0.53	5.56	0.42	28	3.16	1740
Long Pd. (Sheffield)	7.20	18.4	8.31	0.56	5.12	0.42	48	1.92	1682
Miller Pd. (Strafford)	6.95	15.5	7.47	0.84	7.21	0.83	49	2.29	1323
L. Ninevah (Mt. Holly)	6.30	3.2	2.66	0.60	5.58	0.76	22	4.10	1755
Osmore Pd. (Peacham)	6.49	8.4	3.91	0.57	5.28	1.08	34	3.32	1470
Pigeon Pd. (Groton)	6.59	5.7	4.03	0.55	5.94	0.60	30	3.36	954
Somerset Res. (Somerset)	5.51	0.6	1.61	0.40	5.38	0.51	18	5.88	2134
South Pd. (Eden)	6.82	7.2	3.54	1.18	5.69	0.40	29	3.08	1196
South Pd. (Marlboro)	6.34	1.9	2.04	0.54	5.52	0.84	22	4.36	1650
Sugar Hill Res. (Goshen)	6.79	10.6	5.14	1.67	6.68	0.60	42	2.78	1768
Sunset L. (Marlboro)	5.95	1.2	1.61	0.39	4.54	0.78	17	5.11	1370
Wheeler Pd. (Brunswick)	6.41	5.4	3.29	0.70	6.54	0.72	30	3.63	1028
Wolcott Pd. (Wolcott)	6.57	6.8	3.35	1.41	6.02	0.55	31	3.37	1196

*See Appendix II for conversion of mg/1 to µeq/1 (micro equivalents per liter).

FIGURE 2

1980 CSI Values for 25 Vermont Lakes.



Variation of 1980 lake pH data is shown in Figure 3. The annual range in pH for individual lakes varied from a minimum of 0.3 standard units(Wolcott Pd.) to a maximum of 1.0 standard units (Pigeon Pd.). These fluctuations can be significant, particularly in lakes with a pH near critical levels for aquatic organisms and especially if such fluctuations occur during sensitive stages of development. Figure 3 demonstrates the occurrence of pH fluctuations above and below critical levels in several lakes. It is important to note that 1980 data does not include pH observations during or shortly after spring snowmelt events and consequently does not include the annual minimum pH which is likely to occur during this period. It is therefore reasonable to assume that temporary critical pH levels occurred in a greater number of long-term monitoring lakes than is evident from Figure 3.

Determination of Lake Similarities by Cluster Analysis

Similarities between lakes were statistically analyzed using cluster analysis to segregate lakes into similar groups based on eight chemical and physical parameters (Table 2). The groups vary progressively from the most highly sensitive and/or acidified (Group 1) to the least sensitive (Group 4). This trend is evident for all parameters except SO_4 and Cl. The lakes in Group 1 are located in the higher elevations of the Green Mountains (greater than 2000 ft.) and generally in the southern region of these mountains, with the exception of the Lake of the Clouds, the highest lake in Vermont (elevation approximately 3,950 ft.). It is evident from the mean pH for this group (4.86) that these high elevation lakes have undergone a reduction in pH over the past several decades since a hydrogen ion concentration of this magnitude can only be explained by the addition of strong acids (acid precipitation.)[12,13] It is difficult however to determine the precise magnitude of this change due to the lack of valid historical data. Group 2 includes lakes that are generally less than 2000 ft. in elevation (exception, Grout Pond, elevation 2225 ft).

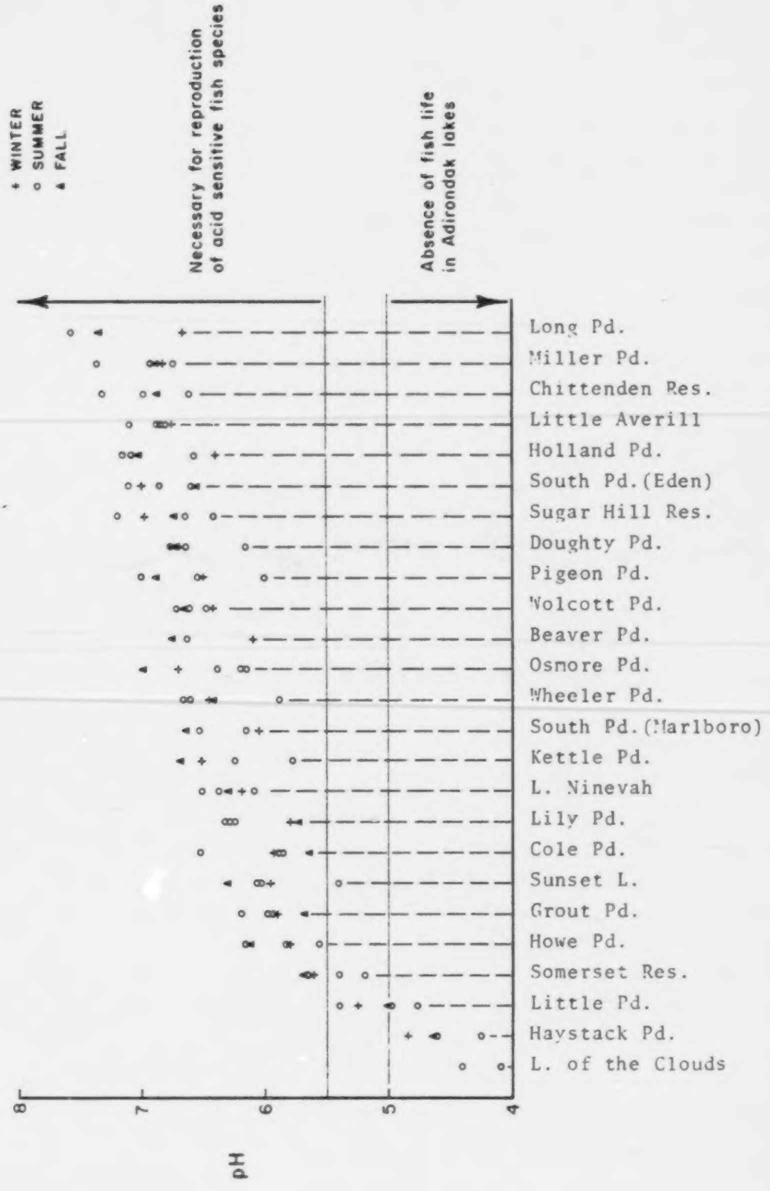


FIGURE 3

1980 pH Values for 25 Vermont Lakes

Table 2. Cluster Analysis Grouping of 25 Vermont Lakes*
Using Statistically Standardized Variables

PARAMETERS	GROUP #1 Lake of the Clouds Haystack Pd. Somerset Res. Little Pd.	GROUP #2 Cole Pd. Osmore Pd. Grout Pd. Sunset Lake Howe Pd. Lake Ninevah South Pd. (Marlboro) Lily Pd.	GROUP #3 Beaver Pd. Little Averill Lake Holland Pd. Pigeon Pd. Kettle Pd. Wheeler Pd. South Pd. (Eden) Wolcott Pd.	GROUP #4 Chittenden Res. Doughty Pd. Sugar Hill Res. Miller Pd. Long Pd.
pH	4.86	6.13	6.61	6.89
Alk	0.3	3.1	5.6	15.2
Ca	1.37	2.30	3.74	6.29
Mg	0.35	0.56	0.74	1.22
$SO_4^=$	6.11	5.35	6.06	6.60
Cl-	0.82	0.84	0.54	0.72
Cond	21.0	22.0	29.0	46.0
CSI	6.93	4.45	3.39	2.45

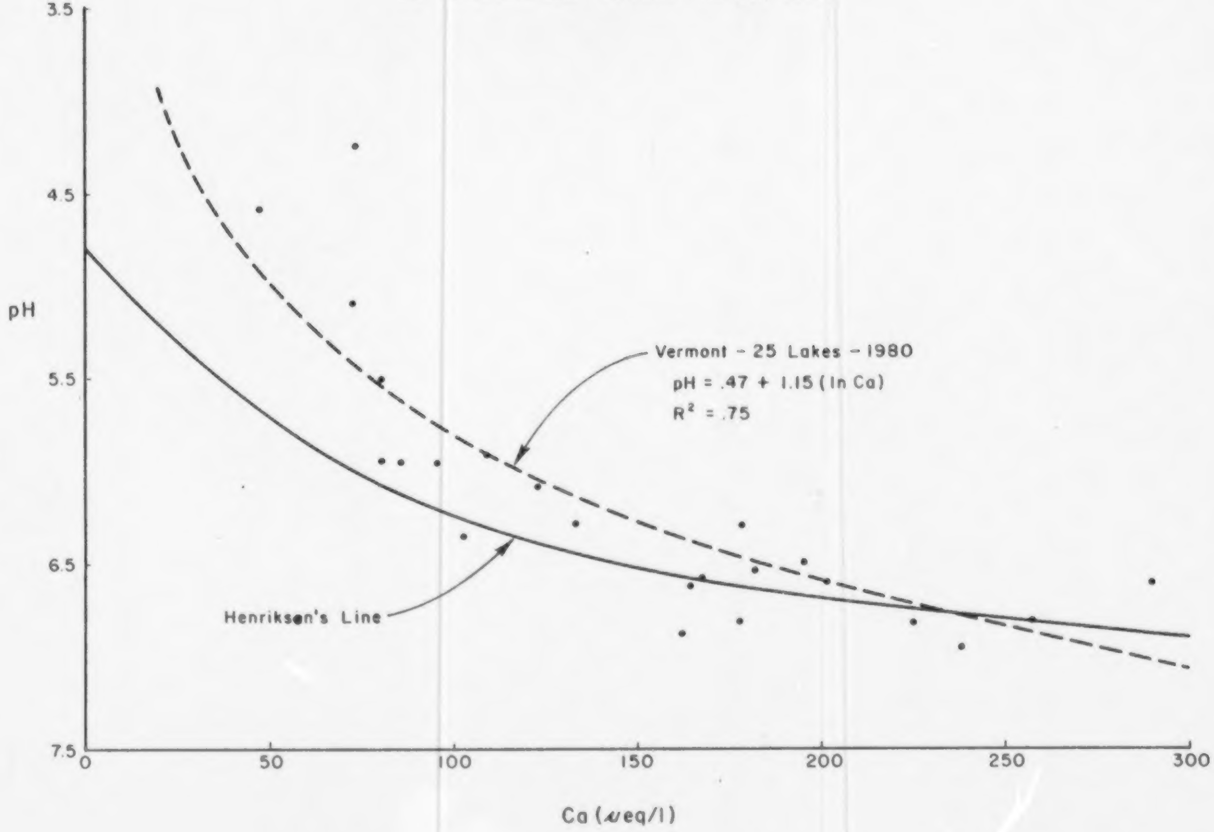
*See Appendix 3 for figure of cluster analysis but more importantly all lakes in this group are underlain by very slow weathering bedrock. As in Group 1, the great majority of lakes in this group are situated in the southern Green Mountains (except Osmore Pond). Lakes in Group 3 are located in northern regions of the State in areas underlain by igneous and/or slow weathering metamorphic bedrock. Calcium, magnesium, alkalinity and conductivity data for Group 3 suggests that bedrock and soil weathering rates are slightly higher for areas represented by these lakes than for the southern Green Mountains. No geographical uniformity is evident for lakes in Group 4. In general, these lakes are situated in areas with more rapidly weathering bedrock and soils than the previous groups and therefore these lakes exhibited the highest buffering capacity.

Qualitative Assessment of the Impact of Acid Precipitation on Vermont Lakes

An approximation of the impact of acid precipitation on surface waters can be estimated even if accurate historical data is lacking, using present day chemical data and data from similar lakes in areas not receiving acid precipitation. One such qualitative method utilizes an empirically derived curve for nonacidified Norwegian lakes[14] (Figure 4). The solid line (Henriksen's line) depicts the curve for lakes in northern and northwestern Norway, i.e., those areas where the impact of acid precipitation is slight or nonexistent. In theory, the line represents the lowest probable pH for an observed calcium concentration in nonaffected areas. Therefore, those lakes falling above this line have pH values lower than expected; presumably the effect of acid precipitation. Two precautions should be noted in any interpretation of Henriksen's curve. First, it is not valid for lakes which have a high concentration of organic acids.

FIGURE 4

Ca Vs pH in 25 Vermont Lakes, 1980



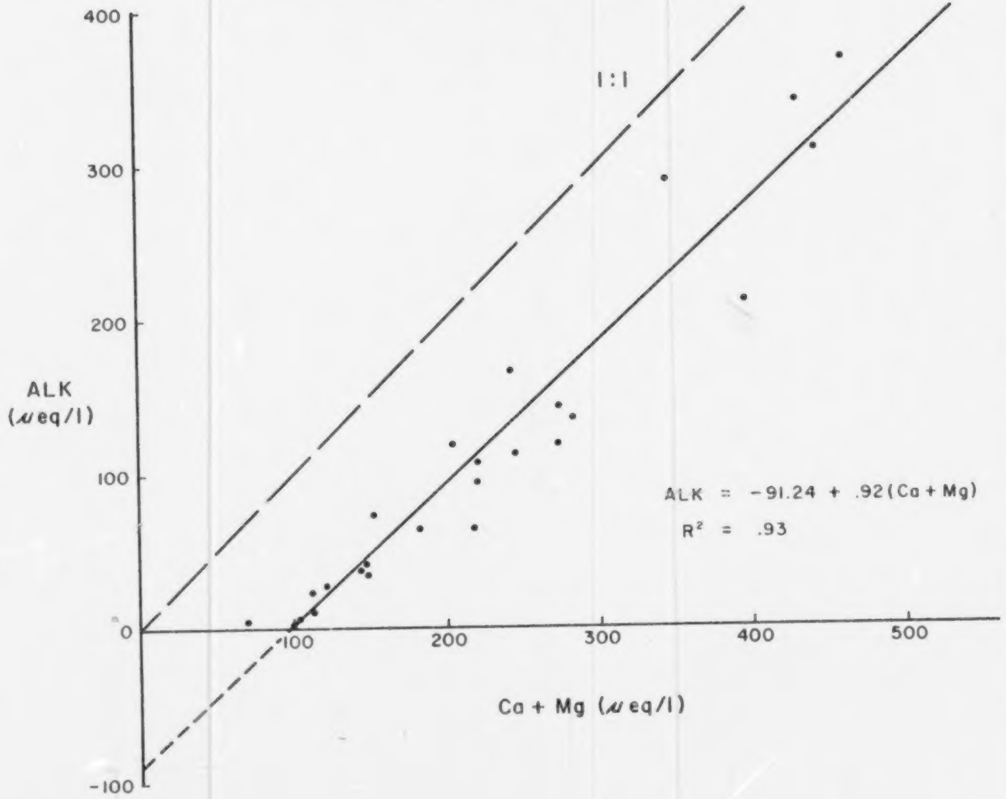
Organic acids will produce a lower than expected pH for a given calcium concentration and therefore indicate a reduction in pH (acidification) when in fact none has occurred. Secondly, this curve assumes a relatively constant ratio between calcium and magnesium. It is a generally accepted principle that Ca and Mg carbonates comprise the great majority of bicarbonate alkalinity in surface waters. Hence, if magnesium concentrations (in association with carbonate) fall significantly below that assumed by the average Ca/Mg ratio then the alkalinity and therefore the pH will be lower than that predicted by calcium alone.

Comparison of Vermont data with Henriksen's curve shows that the majority of the 25 lakes fall above this line; particularly those lakes with low calcium concentrations (Figure 4). This is not unexpected since those lakes with low calcium levels will be the first to experience loss of buffering capacity and therefore experience the earliest and most severe reductions in pH. A point of particular interest is the wide variability in pH for those lakes with calcium levels between 50 and 100 μ eq/l (pH 4.25-5.96). Based on calcium alone, one would expect very similar pH values. Obviously, factors other than calcium are influencing the pH. This variability is most likely attributable to hydrologic and elevation related factors such as lake detention time, soil depth, watershed topography and size, and climate.

Combination of present day magnesium and calcium data provide an additional substantiation of the impact of acid precipitation on Vermont lakes. This is again based on the fact that the sum of calcium and magnesium occur in approximately equal concentrations as bicarbonate alkalinity (on an equivalent basis) in lakes unaffected by acid precipitation. The line defining the 1:1 relationship in Figure 5 illustrates this Ca + Mg/alkalinity relationship in unaffected areas.[15] In contrast, the Ca + Mg/alkalinity relationship for Vermont lakes shows alkalinity levels lower than expected based on cobmined Ca and Mg levels. This implies a reduction in alkalinity produced by the addition of strong acids in acid precipitation.

FIGURE 5

Alkalinity Vs Calcium & Magnesium Concentrations
In 25 Vermont Lakes, 1980



The regression line for Vermont lakes in Figure 5 indicates that loss of bicarbonate alkalinity is characteristic of Vermont lakes with combined Ca and Mg concentrations below 100 μeq/l. However, the slope of this regression line is biased by inaccurate alkalinity values at the extreme lower portion of the line. These extremely low alkalinity values are actually negative values (acidity-dotted line) and as such are below the detection limit for the present method of alkalinity determination. Incorporation of these negative alkalinity values will increase the slope of the regression line thereby indicating a loss of bicarbonate alkalinity at combined Ca and Mg levels slightly higher than 100 μeq/l.

Quantitative Assessment of the Effects of Acid Precipitation on Vermont Lakes

Calcium and magnesium data can also be used to obtain quantitative estimates of alkalinity reduction in Vermont lakes. Pre-acidification alkalinities can be estimated by summing the equivalent concentrations of Ca and Mg. Present day alkalinities can then be compared to this value to approximate the alkalinity reduction (Equation 2):

(2). $ALK_R = (\text{Ca } \mu\text{eq/l} + \text{Mg } \mu\text{eq/l}) - ALK_P$

where: ALK_R = alkalinity reduction,
ALK_P = present day alkalinity and
(Ca μeq/l + MG μeq/l) = pre-acidification alkalinity.

For the 25 long-term monitoring lakes, the 1980 mean pre-acidification alkalinity was 229 μeq/l. In contrast ALK_P averaged 117 μeq/l for the lakes as a group, producing an ALK_R of 112 μeq/l or slightly more than 5.5 mg/l.

A similar method for estimating ALK_R has been employed using the relationship between alkalinity and calcium developed for unimpacted lakes in the Experimental Lakes Area of Canada (Equation 3):

(3). Acidification = (1.42 Ca µeq/l - 32) - alkalinity[14]

where: acidification = ALK_R,
(1.42 Ca µeq/l - 32) = pre-acidification alkalinity,
and alkalinity = ALK_P.

Applying 1980 mean Ca and alkalinity data to Equation 3, gives an estimated ALK_R of 91 µeq/l or approximately 4.5 mg/l. Averaging the estimates for both methods, the alkalinity reduction has been approximately 5 mg/l (100 µeq/l) over the past several decades.

Currently there is no evidence that alkalinity reductions in sensitive lakes have stabilized. For Vermont this means that alkalinity reductions similar to those experienced in the past will continue if acidic inputs are not reduced. Examination of previous data from 121 Vermont lakes (February-March 1980) reveals 21 lakes with an alkalinity in the range of 0-5 mg/l. These lakes will undoubtably experience loss of bicarbonate alkalinity and concurrent rapid reductions in pH to below critical levels within the next several decades. In addition, a much higher percentage of smaller, higher elevation lakes, not yet surveyed, can be expected to have equally low alkalinities[4] and undergo similar alterations.

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APPENDIX I

1980 Acid Precipitation Lake Monitoring Program - Physical and Chemical Results

LAKE	DATE	PH mg/1	ALK mg/1	CA mg/1	MG mg/1	SO4 mg/1	CL mg/1	SC uomhs/cm	CSI
Beaver Pd.	06MAR80	6.09	3.9	4.07	0.44	—	—	—	4.01
	29AUG80	6.63	2.9	3.44	0.45	6.05	0.49	24	3.67
	07OCT80	6.75	3.0	3.35	0.42	5.33	0.50	27	3.55
Chittenden Res.	02JUN80	6.61	12.0	4.81	1.76	—	2.21	—	2.93
	15JUL80	6.99	11.4	4.53	1.83	6.12	0.70	49	2.60
	26AUG80	7.30	17.0	5.60	0.21	5.50	0.58	43	2.02
	20OCT80	6.87	17.6	4.10	1.44	7.42	0.51	39	2.57
Cole Pd.	19FEB80	5.94	3.2	2.39	0.75	—	—	—	4.48
	11JUN80	6.52	2.2	1.63	0.55	5.95	1.51	23	4.23
	21JUL80	5.88	1.5	1.72	0.59	5.16	0.57	22	5.01
	18AUG80	5.85	1.2	1.94	0.64	5.93	1.67	25	5.08
	14OCT80	5.63	0.7	1.85	0.67	6.20	1.65	24	5.56
Doughty Pd.	11FEB80	6.70	16.8	7.59	1.92	—	—	—	2.50
	16JUN80	6.75	25.0	5.69	1.64	8.52	0.68	48	2.40
	16JUL80	6.16	12.4	5.15	1.66	7.92	0.77	51	3.34
	26AUG80	6.65	14.5	5.49	1.61	6.85	0.72	45	2.75
	20OCT80	6.72	16.3	5.05	1.81	7.02	0.92	38	2.67
Grout Pd.	20FEB80	5.91	1.9	2.09	0.48	—	—	—	4.79
	17JUN80	6.20	1.1	1.74	0.43	4.52	0.53	20	4.82
	21JUL80	5.98	1.0	1.45	0.42	5.25	0.70	16	5.16
	18AUG80	5.96	1.2	1.55	0.46	4.62	0.52	16	5.07
	14OCT80	5.68	1.0	1.69	0.43	4.00	0.51	16	5.14
Haystack Pd.	20FEB80	4.84	0.2	1.22	0.29	—	—	—	7.07
	22JUL80	4.24	0.2	0.67	0.25	4.92	0.49	16	7.93
	19AUG80	4.62	0.2	0.94	0.25	4.30	0.44	16	7.41
	15OCT80	4.64	0.5	0.92	0.27	4.19	0.46	15	7.00
Holland Pd.	06MAR80	6.39	5.6	5.97	0.66	—	—	—	3.39
	26JUN80	7.15	4.7	3.90	0.54	6.64	0.67	26	2.89
	30JUL80	6.57	5.9	4.05	0.56	6.56	0.52	28	3.35
	29AUG80	7.07	6.7	4.41	0.59	6.69	0.60	30	2.76
	07OCT80	7.03	6.9	4.23	0.55	6.13	0.46	34	2.81

LAKE	DATE	PH mg/1	ALK mg/1	CA mg/1	MG mg/1	SO4 mg/1	CL mg/1	SC uomhs/cm	CSI
Howe Pd.	20FEB80	5.80	2.7	2.70	0.55	—	—	—	4.64
	17JUN80	6.15	1.8	1.86	0.42	6.35	0.72	21	4.63
	22JUL80	5.67	1.2	1.81	0.43	6.29	0.67	18	5.29
	19AUG80	5.83	2.0	2.28	0.52	5.24	0.70	19	4.81
	14OCT80	6.13	3.0	2.21	0.49	5.08	0.79	19	4.35
Kettle Pd.	05FEB80	6.52	5.2	4.53	0.59	—	—	—	3.41
	24JUN80	5.79	4.1	3.02	0.46	7.02	0.53	31	4.42
	17JUL80	6.25	4.3	3.24	0.50	5.60	0.66	33	3.91
	30SEP80	6.69	5.4	3.44	0.52	6.89	0.50	31	3.34
L. of the Clouds	10JUL80	4.41	0.2	1.28	0.34	6.80	0.53	—	7.48
	24SEP80	4.09	0.1	1.64	0.35	9.74	0.31	31	8.00
Lily Pd.	19FEB80	5.80	2.7	2.30	0.70	—	—	—	4.71
	16JUN80	6.25	3.0	2.18	0.79	6.83	0.50	25	4.24
	21JUL80	6.32	3.2	2.39	0.83	5.67	0.59	24	4.10
	18AUG80	6.30	5.0	2.67	0.87	4.90	0.84	24	3.88
	14OCT80	5.72	4.6	2.70	0.99	5.49	0.53	25	4.49
Little Pd.	20FEB80	5.25	0.5	2.01	0.45	—	—	—	6.05
	18JUN80	5.40	0.2	1.35	0.36	6.58	0.53	22	6.47
	22UUL80	4.77	0.1	0.92	0.34	5.98	1.46	18	7.57
	19AUG80	4.99	0.2	1.40	0.37	6.16	0.40	18	6.86
	15OCT80	5.00	0.6	1.61	0.37	6.62	0.40	19	6.32
Little Averill L.	19FEB80	6.76	6.0	4.38	0.63	—	—	—	3.12
	26JUN80	7.10	5.7	2.18	0.34	7.17	0.64	32	3.11
	30JUL80	6.78	6.0	2.75	0.56	5.10	0.34	25	3.30
	27AUG80	6.87	6.3	3.43	0.59	5.48	0.32	26	3.10
	06OCT80	6.82	6.2	3.43	0.55	4.49	0.36	27	3.15
Long Pd.	25FEB80	6.68	17.7	8.79	0.58	—	—	—	2.43
	29AUG80	7.57	18.7	8.28	0.57	5.37	0.40	46	1.54
	07OCT80	7.34	18.9	7.86	0.52	4.87	0.43	49	1.79
Miller Pd.	07FEB80	6.85	14.7	8.36	0.90	—	—	—	2.36
	11JUN80	6.93	13.2	6.93	0.77	7.38	0.77	46	2.41
	15JUL80	6.74	16.1	6.81	0.84	7.11	1.00	56	2.52
	29AUG80	7.35	17.2	7.60	0.82	7.22	0.74	49	1.83
	21OCT80	6.86	16.5	7.63	0.87	7.13	0.80	45	2.34

APPENDIX I(cont.)

LAKE	DATE	PH mg/1	ALK mg/1	CA mg/1	MG mg/1	SO4 mg/1	CL mg/1	SC uomhs/cm	CSI
L. Ninevah	11FEB80	6.18	4.0	3.60	0.71	—	—	—	3.96
	16JUN80	6.52	3.3	2.46	0.55	6.18	0.63	26	3.87
	16JUL80	6.09	1.8	2.20	0.55	5.68	1.01	24	4.61
	29AUG80	6.39	3.4	2.46	0.62	5.29	0.72	22	3.99
	21OCT80	6.30	3.5	2.56	0.58	5.19	0.70	18	4.05
Osmore Pd.	05FEB80	6.71	8.9	5.66	0.76	—	—	—	2.89
	24JUN80	6.19	6.6	3.06	0.49	5.44	1.12	32	3.81
	17JUL80	6.39	7.5	3.13	0.49	—	1.32	36	3.54
	08AUG80	6.17	10.0	3.78	0.54	5.11	0.69	33	3.55
	30SEP80	6.97	8.8	3.90	0.56	5.29	1.18	35	2.80
Pigeon Pd.	07FEB80	6.52	6.0	4.95	0.59	—	—	—	3.31
	24JUN80	6.00	5.1	3.48	0.52	6.36	0.61	31	4.05
	21JUL80	6.53	5.4	3.30	0.51	5.75	0.59	31	3.52
	08AUG80	7.00	5.5	3.78	0.54	5.78	0.63	29	2.98
	30SEP80	6.89	6.3	4.65	0.57	5.86	0.57	30	2.94
Somerset Res.	20FEB80	5.60	0.8	2.07	0.41	—	—	—	5.48
	18JUN80	5.65	0.4	1.48	0.38	5.38	0.49	20	5.88
	22JUL80	5.19	0.2	1.31	0.39	5.45	0.48	17	6.69
	19AUG80	5.41	0.7	1.59	0.43	5.52	0.51	19	5.84
	15OCT80	5.68	0.8	1.61	0.40	5.19	5.56	18	5.51
South Pd. (Eden)	06MAR80	7.00	8.2	4.05	1.19	—	—	—	2.78
	23JUN80	7.10	6.4	3.55	1.15	6.07	0.42	29	2.84
	21JUL80	6.58	6.2	3.30	1.14	5.63	0.44	30	3.41
	08AUG80	6.85	7.5	3.43	1.15	5.48	0.40	27	3.04
	29SEP80	6.56	7.6	3.39	1.25	5.59	0.33	30	3.33
South Pd.	19FEB80	6.05	2.0	2.77	0.54	—	—	—	4.51
	12JUN80	6.53	1.9	1.86	0.68	5.79	0.87	31	4.22
	22JUL80	—	—	1.52	0.47	5.39	0.81	19	—
	20AUG80	6.16	1.7	2.14	0.52	5.55	0.76	19	4.58
	16OCT80	6.63	1.9	1.90	0.48	5.33	0.92	21	4.11
Sugar Hill Res.	11FEB80	6.99	10.0	5.61	2.04	—	—	—	2.56
	09JUN80	6.40	7.9	5.19	1.13	7.64	0.62	45	3.29
	15JUL80	6.64	11.5	4.95	1.68	6.81	0.72	46	2.91
	26AUG80	7.18	12.2	5.53	1.38	6.94	0.50	41	2.29
	20OCT80	6.75	11.5	4.43	2.10	5.34	0.56	37	2.84

APPENDIX I(cont.)

LAKE	DATE	PH mg/1	ALK mg/1	CA mg/1	MG mg/1	SO4 mg/1	CL mg/1	SC uomhs/cm	CSI
Sunset L.	19FEB80	5.97	1.8	1.88	0.39	—	—	—	4.80
	12JUN80	6.03	0.8	1.59	0.36	4.66	0.70	17	5.17
	23JUL80	6.04	0.5	1.51	0.42	4.85	0.94	19	5.38
	20AUG80	5.41	1.2	1.58	0.40	4.35	0.72	16	5.61
	16OCT80	6.31	1.7	1.43	0.36	4.29	0.74	16	4.61
Wheeler Pd.	27FEB80	6.46	6.4	4.05	0.93	—	—	—	3.43
	25JUN80	6.60	3.9	2.97	0.60	6.78	0.91	33	3.64
	30JUL80	6.66	5.8	2.98	0.61	6.15	0.65	27	3.40
	27AUG80	5.89	5.8	3.28	0.66	6.26	0.61	29	4.13
	06OCT80	6.44	5.3	3.18	0.68	6.99	0.70	32	3.63
Wolcott Pd.	05MAR80	6.45	8.3	3.72	1.49	—	—	—	3.36
	23JUN80	6.72	6.1	3.10	1.35	6.16	0.54	31	3.30
	17JUL80	6.42	5.7	3.18	1.36	5.70	0.67	34	3.62
	08AUG80	6.62	6.8	3.39	1.40	5.95	0.52	30	3.32
	29SEP80	6.66	7.3	3.37	1.46	6.28	0.47	29	3.25

APPENDIX 2

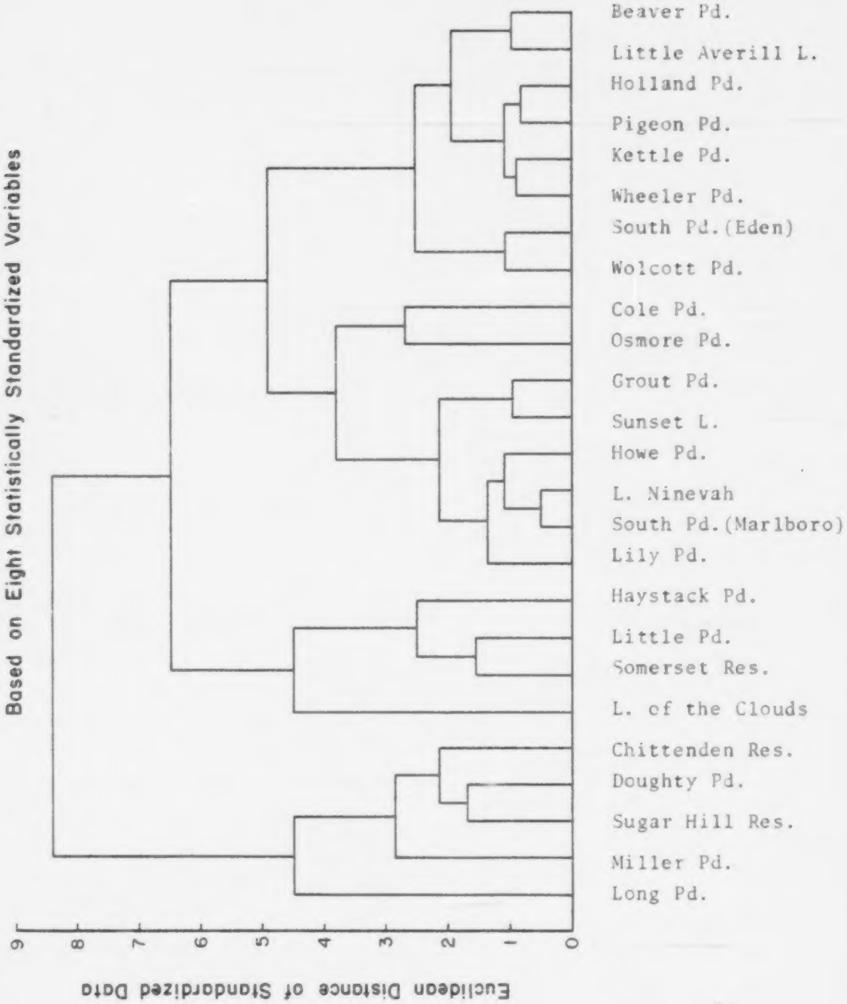
CONVERSION FACTORS - mg/1 to µeq/1

Calcium	mg/1 X 50.0	=	µeq/1
Magnesium	mg/1 X 83.2	=	µeq/1
Sulfate	mg/1 X 20.8	=	µeq/1
Chloride	mg/1 X 28.2	=	µeq/1
Alkalinity	mg/1 X 20.0	=	µeq/1
pH	10^6 X (10^{-pH})	=	µeq/1

APPENDIX 3

Cluster Analysis of 25 Vermont Lakes

Based on Eight Statistically Standardized Variables



A REPORT
ON THE EFFECTS OF ACID PRECIPITATION ON SEVERAL VERMONT LAKES

The effects of acid precipitation on Vermont lakes was first monitored by the Department of Water Resources in the spring of 1979. This preliminary survey was intended to outline those geographical areas which contained surface waters sensitive to acid precipitation. The data generated by this survey confirmed that lakes in some areas of Vermont were sensitive to acid precipitation. The data also indicated that an expanded survey of Vermont lakes was needed to more clearly define both the potential and actual effects of acid precipitation on Vermont lakes.

In February and March, 1980, an extensive survey of Vermont lakes was undertaken by the Vermont Department of Water Resources. Approximately 120 lakes over 20 acres were sampled. Lakes were selected which encompassed a wide variety of geologic areas. Emphasis, however, was placed on those lakes which were thought to be sensitive to acid precipitation. As a result the data in the accompanying figures is not an average value for all Vermont lakes but is biased towards the more sensitive lakes.*

Lake pH data from the 1979 and 1980 surveys (Figure I) reveals two main geographical areas with pH below 6.5; the southern third of the Green Mountains and extreme northeastern Vermont. Graphical representation of pH data (Figure II) indicates that the great majority of lakes sampled were above pH 5.5; the limit generally regarded as necessary for healthy populations and good reproduction of sensitive fish species.

---

* Baseline data for 1980 acid precipitation lake survey available upon request.

In fact, only two of the lakes sampled were below pH 5.5. It should be noted, however, that the above data is based on a single analysis for each lake and that subsequent pH analysis may reflect lower or higher values depending on the time of year.

The isopleth map of lake alkalinity data (Figure III) is quite similar to the pH data except for two notable differences. First, the area encompassing low alkalinity lakes ($<$ 20 mg/l) in the southern Green Mountains and northeastern Vermont is greater than the geographical range of low pH lakes. Secondly, there is a third significant area of low alkalinity lakes in central Vermont (Groton State Forest) which is not indicated by the pH isopleth map. These areas encompassing low alkalinity lakes are underlain by granite or other slow weathering bedrock and in general the lakes can be characterized as oligotrophic or tannic colored.

Graphical representation of lake alkalinity data (Figure IV) differs significantly from the pH data. Although the pH of the majority of lakes was centered near neutrality (pH 7.0) the buffering capacity of the majority of lakes was very low ($<$ 20 mg/l). This suggests that even though these lakes have not yet been acidified they are potentially susceptible to continued inputs of acid precipitation.

In order to further define the sensitivity of Vermont lakes, pH and alkalinity data were combined with calcium data to calculate the calcite saturation index (CSI, Figure V). The

The CSI is based on the predominance of $CaCO_3$ in lake buffering systems and its subsequent influence on alkalinity and pH values.

Figure V shows that seventeen of the lakes sampled possess very little natural resistance to changes induced by acid precipitation (CSI > 4)*. An additional 25 lakes exhibit greater resistance (CSI 3-4) but they must still be considered susceptible to future long-tern inputs of acid precipitation.

The Department of Water Resources is now initiating a long-term study (10 years) on approximately 24 of the more sensitive lakes. These lakes will be sampled six times per year and in addition to pH, alkalinity and calcium; magnesium sulfate, chloride, color and conductivity will be analyzed. Two of these lakes will also include an intensive analysis of the biological community. It is hoped that this study will provide some much needed information on seasonal and long-term trends in lake chemistry and biology.

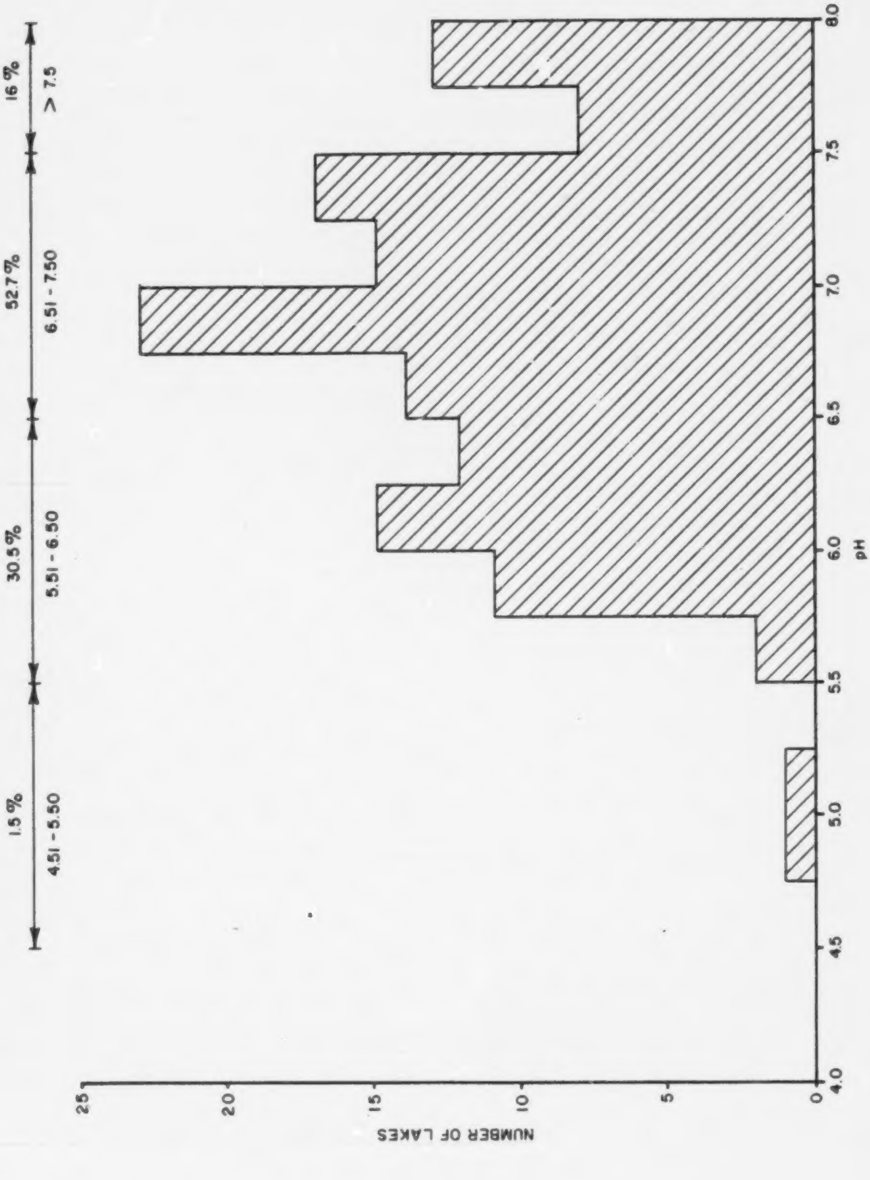
The lake study will be complimented by a long-term study of precipitation pH. An estimated twelve precipitation collectors will be located at the U.S. Weather Bureau precipitation monitoring stations throughout the State. This study is intended to discover any long-term or seasonal trends in precipitation pH as well as indicating any geographical differences in precipitation pH.

In addition to these studies, the Department of Water Resources is actively participating with other departments and organizations on the Vermont Task Force on Acid Precipitation and is continuing efforts to keep abreast of current information and research on the problem. The University of Vermont has recently begun to compile information on forest, agricultural and aquatic systems in Vermont and to determine which, by nature of its species composition, soils, geology and land use practices are most sensitive to acid precipitation.

---

*CSI will vary seasonally, depending on pH and alkalinity values.

For additional information on Vermont's acid precipitation programs, please contact Wallace M. McLean, Chief, Monitoring and Surveillance at 802-828-2761.



DISTRIBUTION OF pH IN SELECTED VERMONT LAKES (1979-1980)

FIGURE 2.

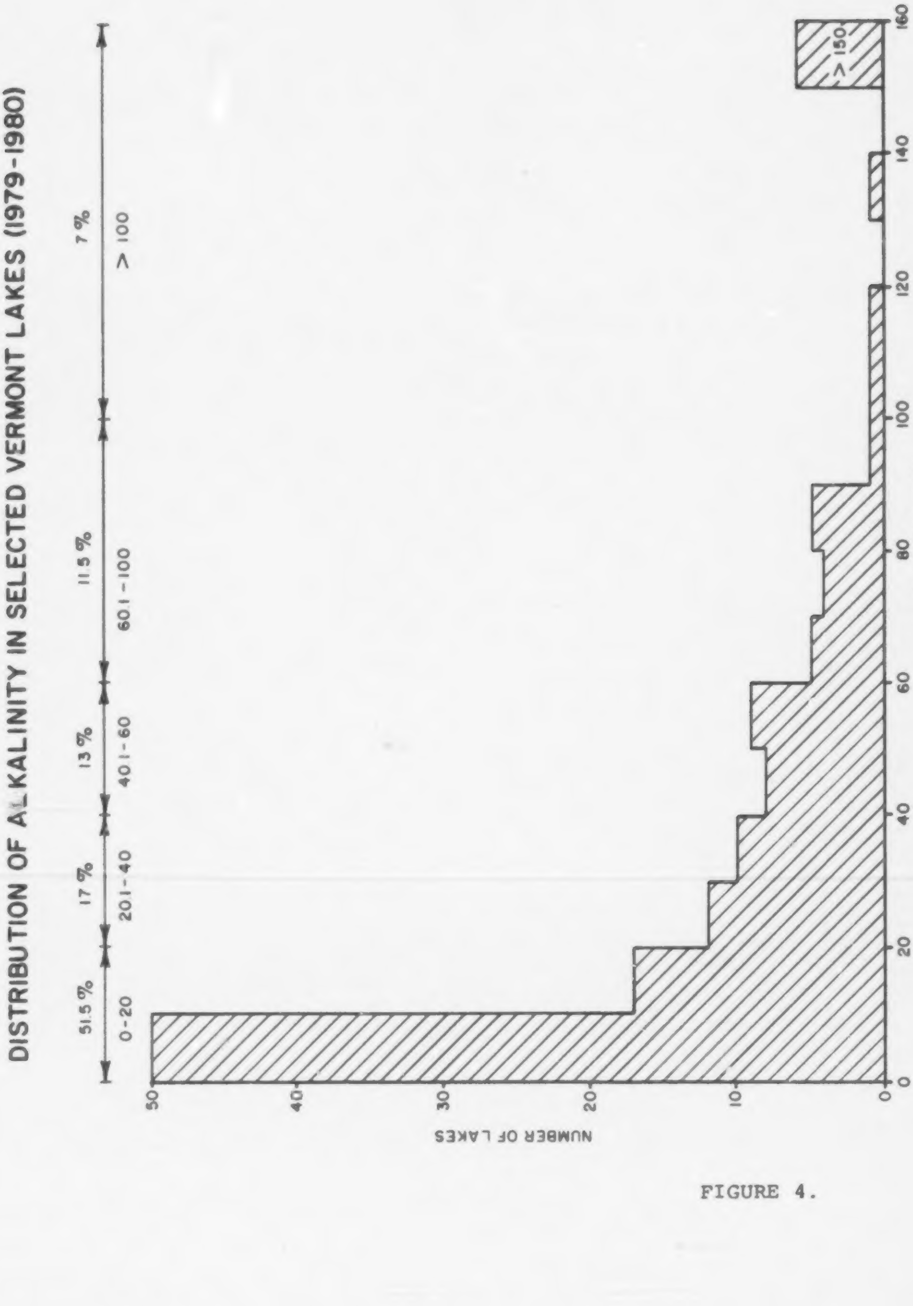
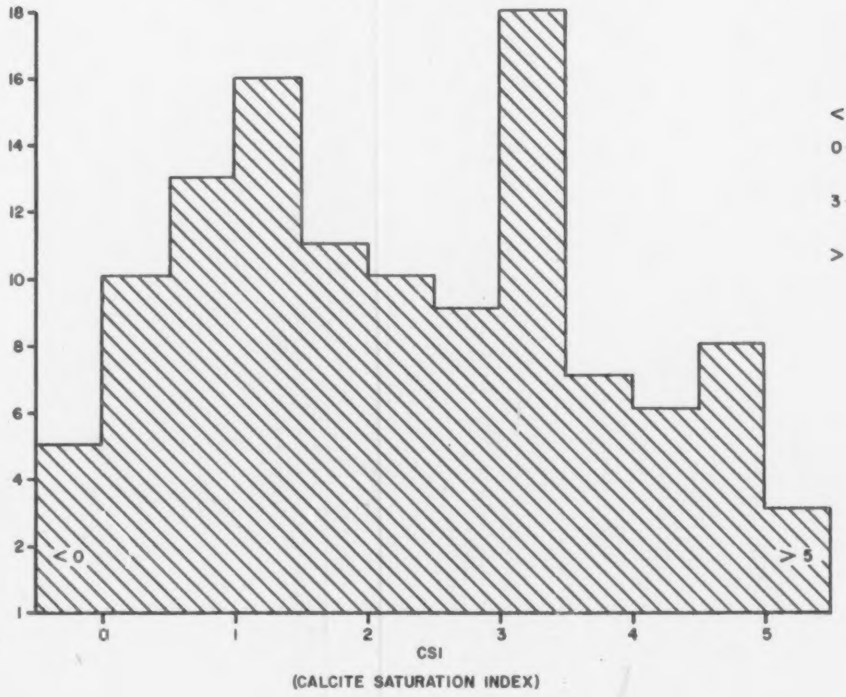

DISTRIBUTION OF ALKALINITY IN SELECTED VERMONT LAKES (1979-1980)
51.5 %
0-20
17 %
20.1-40
13 %
40.1-60
11.5 %
60.1-100
7 %
> 100
> 150
NUMBER OF LAKES
0
10
20
30
40
50
ALKALINITY (mg/l)
0
20
40
60
80
100
120
140
160

FIGURE 4.

DISTRIBUTION OF SELECTED VERMONT LAKES RELATIVE TO THE CALCITE SATURATION INDEX

$$CSI = p(CA^{+2}) + p(ALK) - p(H^{+}) + pK$$



CSI*

< 0	SUPERSATURATED WITH $CaCO_3$, NO DANGER
0 - 3	GENERALLY STABLE RELATIVE TO ACID LOADING
3 - 4	SOME UNSTABILITY RELATIVE TO ACID LOADING
> 4.0	UNSTABLE RELATIVE TO ACID LOADING, TYPICALLY NON PRODUCTIVE

*KRAMER, J.R., GEOCHEMICAL AND LITHOLOGICAL FACTORS IN ACID PRECIPITATION IN: "FIRST INTERNATIONAL SYMPOSIUM ON ACID PRECIPITATION AND THE FOREST ECOSYSTEM", pp. 611-618, USDA TECH. REP. NE-23

FIGURE 5.

JUL 07 1981

385 Elliot Street, Newton Upper Falls, Ma. 02164, p.o. box 427 • (617) 969-1090

AMERICAN LUNG ASSOCIATION *of Massachusetts*

(formerly Massachusetts Tuberculosis and Respiratory Disease League)

"It's a Matter of Life and Breath"

Joseph F. Sweeney, *President*
Louis Carvelli, *Executive Director*

SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
FIELD HEARING ON POLLUTION TRANSPORT
RANDOLPH, VERMONT JUNE 30, 1981

The American Lung Association of Massachusetts wishes to be included in the record of Senator Stafford's June 30, 1981 field hearing on pollution transport which is being held in Randolph, Vermont. As a voluntary health organization, our main concern is the control and prevention of lung disease.

Long range pollution transport is a serious public health concern. Presently, Massachusetts is unable to attain the National Ambient Air Quality Standard for ozone. Much of the ozone comes to Massachusetts from the states to our south and west. Less urban western Massachusetts (which is due north of N.Y.C.) often has higher ozone levels than more urban eastern Massachusetts. Unhealthful ozone levels aggrevate the symptoms of individuals with chronic lung disease, and also affect healthy individuals who are exercising.

Yet, the control of much of this ozone is beyond the jurisdiction of Massachusetts. Section 126 of the Clean Air Act provides the opportunity for only limited control to a problem that demands a coordinated regional strategy. Pollution control should remain the responsibility of the individual states. But the state plans should be consistent with E.P.A. emission control strategies within a regional air pollution transport area. E.P.A. will control the total pollutant loading within a region. It should oversee interstate agreements on emission reductions which will be consistent with this E.P.A. regional plan.

Presently, the Clean Air Act has standards for single pollutants. Yet, pollutants change and interact. The adoption of the ozone standard was recognition that transformed pollutants need control. Sulfates and fine particulates similarly need standards and control strategies. These pollutants are involved in long range transport, but for lack of standards are not even being controlled state by state. The American Lung Association of Massachusetts urges amendments to the Clean Air Act which will allow no further delay in setting these standards.

Massachusetts need Congress to act now during the Clean Air Act's reauthorization to take steps to reduce the threats to public health which are posed by pollutants which have changed their form and have come to our state with the prevailing winds.

Sincerely,

Harold S. Kost, M.D.

Harold S. Kost, M.D.

For additional information contact: Betsy Johnson, environmental programs consultant

CHRISTMAS SEALS *fight — tuberculosis, emphysema, and other respiratory diseases*
support — community action programs against air pollution and cigarette smoking

AMERICAN LUNG ASSN OF NORFOLK/NE
25 SPRING ST
WALPOLE MA 02081

western union Mailgram

4-005945S180 06/29/81 ICS IPMMTZZ CSP WRJB
6174268330 MGM TDMT BOSTON MA 50 06-29 0841A EST

VERMONT LUNG ASSN
30 FARRELL ST
SOUTH BURLINGTON VT 05401

THE NORFOLK - NEWTON LUNG ASSOCIATION OF MASSACHUSETTS WISHES TO ENDORSE THE STATEMENT OF THE AMERICAN LUNG ASSOCIATION OF VERMONT WHICH IS BEING PRESENTED AT SENATOR STAFFORD'S FIELD HEARING IN RANDOLPH VERMONT ON JUNE 30 1981

MARY MILLER

0846 EST

MGMCOMP MGM

AMERICAN LUNG ASSN OF BOSTON E J
2 53 SUMMER ST
BOSTON MA 02210

western union Mailgram

4-005384S180 06/29/81 ICS IPMMTZZ CSP WRJB
6174268330 MGM TDMT BOSTON MA 46 06-29 0833A EST

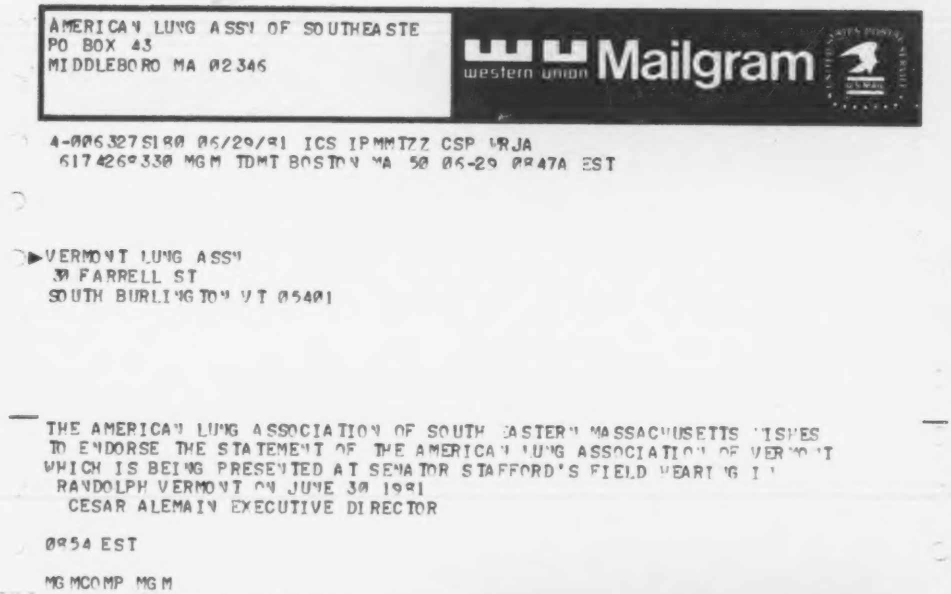
VERMONT LUNG ASSOCIATION
30 FARRELL ST
SOUTH BURLINGTON VT 05401

THE AMERICAN LUNG ASSOCIATION OF BOSTON WISHES TO ENDORSE THE AMERICAN LUNG ASSOCIATION OF VERMONT STATEMENT WHICH IS BEING PRESENTED AT SENATOR STAFFORD'S FIELD HEARING IN RANDOLPH VERMONT ON JUNE 30 1981

LOUIS CARVELLI EXECUTIVE DIRECTOR

0837 EST

MGMCOMP MGM



AMERICAN LUNG ASSN OF SOUTHEASTE
PO BOX 43
MIDDLEBORO MA 02346

western union Mailgram

4-006327S180 06/29/81 ICS IPMMTZZ CSP WRJA
6174268330 MGM TDMT BOSTON MA 50 06-29 0847A EST

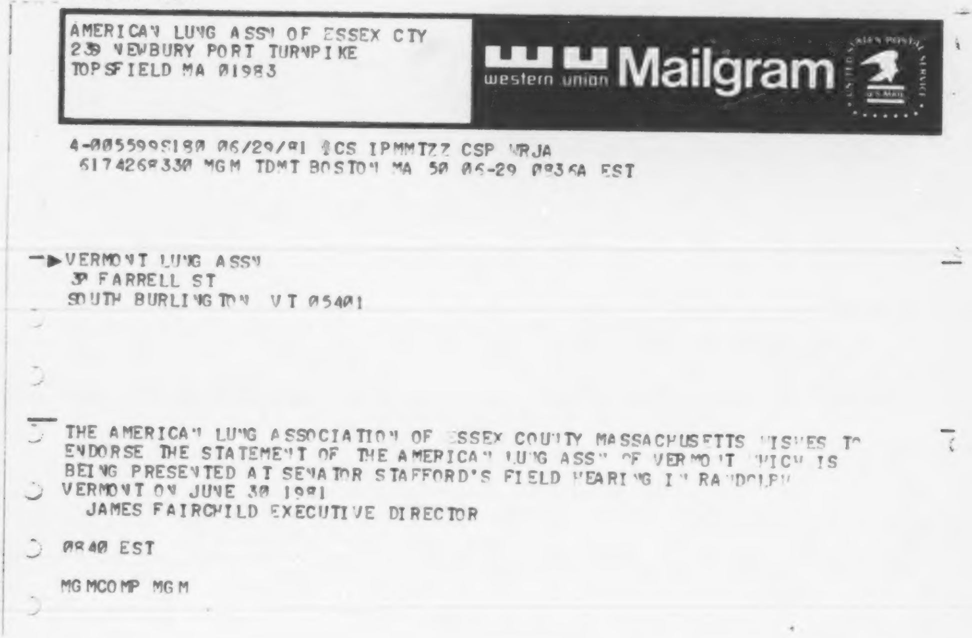
VERMONT LUNG ASSN
30 FARRELL ST
SOUTH BURLINGTON VT 05401

THE AMERICAN LUNG ASSOCIATION OF SOUTH EASTERN MASSACHUSETTS WISHES TO ENDORSE THE STATEMENT OF THE AMERICAN LUNG ASSOCIATION OF VERMONT WHICH IS BEING PRESENTED AT SENATOR STAFFORD'S FIELD HEARING IN RANDOLPH VERMONT ON JUNE 30 1981

CESAR ALEMAIN EXECUTIVE DIRECTOR

0854 EST

MGMCOMP MGM



AMERICAN LUNG ASSN OF ESSEX CTY
239 NEWBURY PORT TURNPIKE
TOPSFIELD MA 01983

western union Mailgram

4-005599S180 06/29/81 ICS IPMMTZZ CSP WRJA
6174268330 MGM TDMT BOSTON MA 50 06-29 0836A EST

VERMONT LUNG ASSN
30 FARRELL ST
SOUTH BURLINGTON VT 05401

THE AMERICAN LUNG ASSOCIATION OF ESSEX COUNTY MASSACHUSETTS WISHES TO ENDORSE THE STATEMENT OF THE AMERICAN LUNG ASSN OF VERMONT WHICH IS BEING PRESENTED AT SENATOR STAFFORD'S FIELD HEARING IN RANDOLPH VERMONT ON JUNE 30 1981

JAMES FAIRCHILD EXECUTIVE DIRECTOR

0840 EST

MGMCOMP MGM

AMERICAN LUNG ASSN OF MIDDLESEX
5 MOUNTAIN RD
BURLINGTON MA 01803

Western Union Mailgram

4-005717S180 06/29/81 ICS IPMMTZZ CSP WRJA
6174268330 MGM TDMT BOSTON MA 50 06-29 0839A EST

VERMONT LUNG ASSN
30 FARRELL ST
SOUTH BURLINGTON VT 05401

THE AMERICAN LUNG ASSOCIATION OF MIDDLESEX COUNTY MASSACHUSETTS
WISHES TO ENDORSE THE STATEMENT OF THE AMERICAN LUNG ASSN OF VERMONT
WHICH IS BEING PRESENTED AT SENATOR STAFFORD'S FIELD HEARING IN RANDOLPH VERMONT ON JUNE 30 1981
MARK MULLIGAN EXECUTIVE DIRECTOR

0842 EST

MGMCOMP MGM

AMERICAN LUNG ASSN OF CENTRAL MA
35 HARVARD ST
WORCESTER MA 01609

Western Union Mailgram

4-005825S180 06/29/81 ICS IPMMTZZ CSP WRJA
6174268330 MGM TDMT BOSTON MA 49 06-29 0839A EST

VERMONT LUNG ASSN
30 FARRELL ST
SOUTH BURLINGTON VT 05401

THE AMERICAN LUNG ASSOCIATION OF CENTRAL MASSACHUSETTS WISHES TO
ENDORSE THE STATEMENT OF THE AMERICAN LUNG ASSOCIATION OF VERMONT
WHICH IS BEING PRESENTED AT SENATOR STAFFORD'S FIELD HEARING IN RANDOLPH
VERMONT ON JUNE 30 1981
JAMES SAART EXECUTIVE DIRECTOR

0844 EST

MGMCOMP MGM

AMERICAN LUNG ASSN OF WESTERN MA
393 MAPLE ST
SPRINGFIELD MA 01105

western union Mailgram

4-006043S180 06/29/81 ICS IPMMTZZ CSP WRJA
6174268330 MGM TDMT BOSTON MA 49 06-29 0843A EST

VERMONT LUNG ASSN
30 FARRELL ST
SOUTH BURLINGTON VT 05401

THE AMERICAN LUNG ASSOCIATION OF WESTERN MASSACHUSETTS WISHES TO ENDORSE THE STATEMENT OF THE AMERICAN LUNG ASSOCIATION OF VERMONT WHICH IS BEING PRESENTED AT SENATOR STAFFORD'S FIELD HEARING IN RANDOLPH VERMONT ON JUNE 30 1981

MARIO SAKELLIS EXECUTIVE DIRECTOR

0848 EST

MGMCOMP MGM

Central Vermont Safe Energy Coalition
Box 1117
Montpelier, Vt. 05602
July 8, 1981

Senator Robert Stafford
Committee on Environment and Public Works
Federal Building
Burlington, Vt. 05401

Dear Mr. Stafford,

I would like to add the position of our organization to your committee's record regarding reauthorization of the Clean Air Act. As an organization that favors a diversified mix of safe, renewable energy sources we favor strengthening, not weakening the Clean Air Act. As was stated so well at the recent hearings the acidification of high altitude lakes and other aquifers in northern New England and New York is becoming a problem of much greater magnitude than was realized when the Clean Air Act was first written. It is a problem that knows no state and national boundaries and is a problem that cannot be adequately controlled by state statutes and enforcement.

The burning of grater quantiities of fossil fuels has increased the amounts of sulfur dioxide, carbon monoxide, nitrogen dioxide, ozone, and lead as well as carbon dioxide in the air. It is the latter - carbon dioxide - that presents one of the trickiest and potentially the gravest of problems in controlling air pollution. According to Environment Magazine , Scientists predict that an increase in CO2 of such magnitude that a greenhouse effect could result, leading to a signifigant rise in world temperatures. While such a prospect might seem inviting to a Vermonter in January, the consequences globally are potentially diastrous and can not be predicted with certainty.

Our conclusion is that a cautious approach is the best. Thus we appreciate your support of the Clean Air Act. We do not feel that nuclear power is a suitable substitute for fossil fuels or vice versa. Rather we feel that strong controls on existing polluters are needed as we develop the barely tapped potential of conservation and renewables.

Sincerely,
George Longenecker
George Longenecker
for the
Central Vermont Safe Energy Coalition

THE CITIZENS' TASK FORCE ON ACID RAIN
c/o NHACC
54 Portsmouth Street
Concord, NH 03301

TESTIMONY TO THE SENATE ENVIRONMENT AND PUBLIC WORKS COMMITTEE

SUBMITTED BY THE NEW HAMPSHIRE CITIZENS' TASK FORCE ON ACID RAIN

Tuesday, June 30, 1981
Randolph, Vermont

The New Hampshire Citizens' Task Force on Acid Rain is a coalition of individuals and organizations, with combined memberships of well over 10,000 New Hampshire residents, concerned about the impact of acid rain on human health and on the region's aquatic and terrestrial ecosystems.

The Task Force was organized to launch a coordinated effort to increase public awareness about the causes and effects of acid rain and to create public support of legislative and administrative programs directed at alleviating the problem.

We believe that the most immediate and effective solution available is the enactment of a strong Clean Air Act.

- Acid rain is an acute symptom of the many problems associated with air pollution.
- We believe that enough evidence is available concerning the cause and effects of acid rain to know that we can spare no time in affecting solutions to the problem.
- Results from recent studies in the Ohio River Valley confirms the fact that sulfate deposition poses a threat to human health in the midwest as well as in the northeast.

We strongly support the reauthorization of the Clean Air Act and urge the committee to address the issue of the long range transport of air pollutants during the reauthorization process.

Thank you for the opportunity to comment.

common cause
NEW HAMPSHIRE and VERMONT
11 Rayton Road
Hanover, NH 03755
603-643-3488

Martha S. Solow
Executive Director

July 6, 1981

Senate Committee on Environment and Public Works
Sen. Robert T. Stafford, Chairman
Room 5219 Dirksen Senate Office Building
Washington, D.C. 20510

Dear Mr. Chairman and Members of the Committee:

On behalf of the over 2100 members of Common Cause in the states of New Hampshire and Vermont, I thank you for having held hearings on the Clean Air Act in Randolph, Vermont, last week. Because we believe that issues of public policy should be based on a national consensus, developed after public debate of the issues, rather than on the interests of only one segment of our national community, we greatly appreciate the efforts your committee is making to reach out to the people in several regions of the country and to learn their views on this important issue.

As we testified at the hearing on June 30th, Common Cause supports the reauthorization of the Clean Air Act and is in favor of amendments which would strengthen it. We in northern New England treasure the clean air we now have, which in large measure is the basis for our economic and aesthetic well-being. We urge the committee to consider favorably amendments which will diminish the effects of acid rain created by pollutants generated by industry in other states. Technical testimony presented at the hearing was eloquent on this point.

Furthermore, we urge that any attempts to transfer authority for setting air quality standards and for enforcement of the Act from the national government to the states be opposed. Neither New Hampshire nor Vermont is equipped financially to accept that authority. Moreover, air quality is a national issue, and should be dealt with at that level of government and not by the states.

Lastly, we remind you that all measures of national public opinion on this issue suggest that there exists a consensus in favor of retaining and strengthening the Clean Air Act. We hope you will respond to that consensus.

Respectfully,

Martha Solow

Martha S. Solow
Executive Director

P. O. Box 233
Springfield, Vermont 05156
July 6, 1981

Honorable Robert T. Stafford
Chairman, U. S. Senate Environment
  and Public Works Committee
Dirkson Senate Office Building
Room 4202
Washington, D.C. 20510

Dear Senator Stafford:

Enclosed is my input for the Hearing on the Clean Air Act at Randolph, Vermont on June 30, 1981.

Sorry I didn't know of the Hearing soon enough to have my comments prepared on that date.

Thank you for the opportunity to submit my input.

Regards,

Melvin G. Hatch

Melvin G. Hatch

MGH:clh
enc.

Belated testimony of Melvin G. Hatch of Springfield, Vermont, to the Senate Committee on the Environment and Public Works.

July 6, 1981.

I wish to thank you, Senator Stafford, for bringing the Hearing to Vermont and giving so many of us an opportunity to voice our opinions and to hear so many authorities on a subject so important to the residents of our fine State.

Most of our residents are not aware of the economic value of recreation in Vermont unless their incomes are directly dependent on it, which I might add many are. Much of what I will address will concern the sport fishing industry, as fishing has been my most important source of relaxation and peace of mind.

Statistics released by Dr. A. Gilbert, Professor Resource Economics, UVM, indicate that in 1980 the sport fishing industry in Vermont had a total value of $75.1 million.

New York state now has approximately 212 lakes in the Adirondacks which are sterile and not habitable by fish or the organisms which provide their food stuff. Wildlife experts estimate that 50,000 North American lakes will go the same route in the next two decades if we are unable or unwilling to control acid precipitation. We cannot afford to wait until all the proof is in and the arguments settled as to how to measure interstate transport of particulate before regulating it.

Must we lose more of our sport fishery and jeopardize the developing Atlantic Salmon fishery in the northeast before we act?

It seems clear to me with the facts available that industries are purposely dumping particulate into the atmosphere under the false pretense of running an environmentally safe industry because the precipitate falls outside their state boundaries.

Some of the facts as I understand them are as follows:

1. Tall stacks were purposely built to cause the transport of pollution beyond areas causing the pollution.

2. At least 30 million tons of sulphur dioxide is dumped into the atmosphere each year in the U.S.

3. There are also international problems, as the U.S. spews approximately 4 million tons of sulphur dioxide per year directly into Canada. (We also receive 1 to 1.5 million tons from Canada.)

4. When the facts are in, we may find heavy metals and other compounds as dangerous or even more so than sulphur dioxide and nitrous oxides.

5. The average PH of the northeastern U. S. rainfall is now 4.0 to 4.2. (Pure rain is 5.6, and vinegar 3.0.)

6. Coal is the largest source of sulphur emmissions.

7. Haze due to pollution has increased in our beautiful northeast.

8. Three times as many die from respiratory problems in Vermont as on our highways. (Interstate transported air pollution most likely is a contributing factor.)

9. 50 to 55% of Vermont's sulphur precipitates is from out of state.

In an effort to slow and eventually control the problem of interstate air pollution in Vermont, I want to encourage the following:

1. Reauthorization of The Clean Air Act.

2. Strengthening of the Clean Air Control Act to limit interstate transport of atmospheric pollution, now!

3. Setting of definite deadlines for when guidelines in #2 must be met.

4. Set into motion a scientific research and monitoring program to study the overall effect of acid rain.

5. Make states and their industries responsible for air standards in the prevailing winds from their state to others.

Telephone 444-3414

THE REV. CARLETON SCHALLER JR.
16 SCHOOL STREET
LITTLETON, NEW HAMPSHIRE 03561

All Saints' Episcopal Church
16 School Street
Littleton, New Hampshire

The Church of the Messiah
North Woodstock
New Hampshire

July 6, 1981

The Honorable Robert T. Stafford
United States Senate
Washington, D.C. 20510

Dear Senator Stafford:

Because I am vitally interested in the Clean Air Act, I regret that I was unable to attend the hearings in Vermont which you recently conducted as Chairman of the Senate Environment and Public Works Committee. Accordingly, I hope that you will include my letter in the written material pertaining to the Clean Air Act and its extension.

I have been a resident of Littleton, New Hampshire for nineteen years. I came here by choice from New York City in 1962. Of supreme importance to me is the quality of the air that I and my neighbors breathe. Of strong concern is the recently publicized problem of acid rain. I earnestly hope that the extension of the Clean Air Act of 1970 will address that important issue. Naturally living where I do, I am keenly aware of what damage might occur to Northern New England's environment if subjected to continued and long-term fall-out of the byproducts of sulfur and nitrogen combustion. But even if I lived elsewhere, I would surely be concerned about the harmful effects of acid rain.

Further, I definitely do not believe that the great advance created by the passage of the Clean Air Act in 1970 should be turned back in favor of elimination of standards,or that health factors should be secondary to economic ones. I simply cannot believe that this great nation would put the well-being of vast numbers of its citizens below the profit motive in importance. Nor do I believe that it makes any sense to make penalties for noncompliance discretionary. If that had been the basis of the 1970 Act, I question whether this country would have made the substantial progress it has in "cleaning up the air".

Rather than relax standards, I believe that the wisest course for the nation to follow in making adjustments to the Act would be to stretch out the timetable for compliance on a case by case basis in those instances where it can be effectively demonstrated that such an extension will afford opportunities for industry, utilities, and municipalities to accomplish the goals for clean air in such a way as to take account of their special situations. In this manner, the maintenance and integrity of the Clean Air Act, the creating of which you personally have had such a vital role, will be assured.

Sincerely,

Carleton Schaller Jr.

The Gratiot Engineering Company
CONSULTING ENGINEERS
39 CENTRAL ST. • WOODSTOCK, VERMONT 05091
802 / 457-2300

29 June 1981

Senator Robert Stafford, Chairman
Senate Committee on the Environment
Washington, D.C. 20510

RE: Clean Air Act

Dear Senator Stafford:

I would like to express some comments on the effectiveness of the Clean Air Act as seen here in Vermont at the present time.

I speak as a private pilot who has been concerned because of that activity and viewing the air around us rather carefully for the last forty years when I've been flying.

There has been a marked, distinct improvement in the visual quality of the air, and I assume that this visual evidence is confirmed by statistical data resulting from air sampling programs in this state and elsewhere. For the last perhaps two to three years, it has been very noticeable that the smog-haze which provided an horizon for us in Vermont has disappeared to a great extent. Ten years ago there was a persistent gray smog layer all over New England substantially all of the time and certainly all the time that the prevailing westerly wind moved air from the Ohio Valley and that general area into Vermont.

I do not have detailed data which permits me to draw inferences as to the precise cause of this change and improvement, although I have always associated it with the imposition of automobile pollution control measures. Clearly, there were very likely other changes going on in the treatment of power plant wastes at the same time.

In any event, these changes in air quality have been extremely noticeable and have clearly improved our air quality in Vermont. I trust that your committee, the Senate and the Congress as a whole will see fit to maintain the strength of these laws which have made such a giant step in improving the quality of the air we breathe and will see to it that the "acid rain" which is receiving so much publicity now will not get a chance to have more severe effects upon the population and growing things in years to come.

Very truly yours,

J. Peter Gratiot, P.E.

VERMONT CONFERENCE OF THE
UNITED CHURCH OF CHRIST, INC.

June 29, 1981

Dear Senator Stafford,

We are pleased that your continuing concern for Quality Environment brings you to Vermont to hold Public hearings on the Clean Air Act, and we recognize you have an important role to play in upholding environmental health as ranking member of the Senate Environment and Public works Committee.

We could here repeat the concerns of other organizations in Vermont and the U.S.A. However, we think they adequately address the issues involved in upholding and strengthening the purpose and methods for ensuring compliance and upgrading.

Suffice it to say we support the points made by the National and Vermont Clean Air Coalitions, Vermont's Agency of Environmental Conservation, and the other groups urging continuance of improvement in air quality. We are strongly in favor of the regard exhibited for Flora and Fauna and the recognition of the symbiotic relationship between humans and

OTHER SPECIES.

CLEAN AIR AND CLEAN WATER ARE PERHAPS TWO OF THE MOST IMPORTANT ISSUES NOW BEFORE US ON A WORLD BASIS. WE ARE FULLY AWARE OF THE VITAL PART THE U.S.A. CAN HAVE IN FURTHERING GLOBAL HEALTH IN THE FUTURE.

AS REPRESENTATIVES OF 22,000 VERMONTERS WE ENCOURAGE YOU IN YOUR EFFORTS TO STAND FIRM ON AN ISSUE THAT SYMBOLIZES AMERICA'S REGARD FOR QUALITY, AND WHICH MAY WELL PROVIDE A MEDIUM FOR COORDINATION AND EDUCATION IN TODAY'S COMPLEX INTERNATIONAL RELATIONSHIPS.

KIND REGARDS,

VERMONT CONFERENCE OF THE
UNITED CHURCH OF CHRIST
DEPARTMENT OF MISSION
ENVIRONMENTAL COMMITTEE
Barry L Hartman

802-457-2779
woodstock
vermont
05091

VERMONT INSTITUTE OF NATURAL SCIENCE

29 June 1981

Senator Robert Stafford
Room 5219
Dirkson Senate Office Building
Washington, D.C.
20510

Dear Senator Stafford:

The Vermont Institute of Natural Science is a statewide environmental education and research organization. We believe that, if a harmony between modern man and his environment is possible anywhere, it is here in Vermont. All our education and research efforts are directed toward creating that harmony.

Although our work is primarily in environmental education and research, we do, at times, feel it necessary to take a political stand. With respect to the issue of the air quality of Vermont and the reauthorization of the Clean Air Act, the Board of Trustees has decided to submit to you the following resolution for inclusion as written testimony for the Senate Environment and Public Works Committee hearing held at the Vermont Technical College in Randolph, Vermont on 30 June 1981.

Resolution of the Board of Trustees
Vermont Institute of Natural Science
Passed 18 June 1981

The Clean Air Act must be reviewed and reauthorized by Congress this session. Industry and utility groups seek to weaken the Act while conservationists hope Congress will retain its best provisions and strengthen it in some key areas.

Therefore be it resolved:

That the Board of Trustees expresses general support of the Clean Air Act which has resulted in improved air quality during the first decade of its enactment, and supports the reauthorization of a strong Act.

That the long-range transport of air pollutants is a phenomenon which needs to be addressed in the Act. Vermont suffers damage in the form of acid rain as a result of emissions elsewhere, especially in the industrial midwest. VINS' on-going research on the Common Loon, as well as on reptiles and amphibians, directly relates to this issue.

That the purpose of the Clean Air Act in protecting areas with cleaner air than the minimum health standards, such as Vermont, should be maintained in the reauthorization with the continuation of the Prevention of Significant Deterioration (PSD) program which protects states having cleaner air from having that air quality degraded to the lowest level allowed by law.

We appreciate the support you have given to the careful review of this vital legislation; and the stand you have made to "fine-tune" it where needed, keeping the integrity of the Act intact and providing additional protection for such areas as acid rain.

As an organization dedicated to the understanding our natural world, and the existence in harmony with it, we will work as best we can, with you to protect our natural resources.

Sincerely,

Sarah B Laughlin

Sarah B. Laughlin
Director

SBL/si

Vermont Law School
South Royalton, Vermont 05068
Telephone: 802/763-8303

JUL 0 8 1981

July 6, 1981

The Honorable Robert T. Stafford
United States Senate
5219 Dirksen Senate Office Bldg.
Washington, D.C. 20510

Dear Senator Stafford:

We would like to thank you for holding the June 30, 1981, hearings at Randolph Center. It is apparent from the tenor of the meeting that there is much concern in Vermont and the northeast regarding the reauthoriaztion of the Clean Air Act. While the hearings seemed concerned with all forms of air pollutants and their long range transport, the overriding issue voiced by everyone was acid precipitation. We hope that the Environment and Public Works Committee of the Senate has and will continue to consider this important issue during the period of reauthorization for the Clean Air Act.

In order to help in your Committee's deliberations over the Clean Air Act and acid precipitation, we would like to submit the enclosed examinations of the acid precipitation for inclusion in the record of testimony from the June 30, 1981 hearing. We urge that as many committee members and staff as possible examine these documents during the deliberations on the Clean Air Act reauthorization.

Again, we would like to thank you for your attention and interest in the air we breathe. If we can be of any further service during these deliberations, please do not hesitate to contact us.

Cordially,

Richard O. Brooks

Richard O. Brooks, Director
Environmental Law Center
Vermont Law School

and

Frank C. Reed

Frank C. Reed, Ph.D.
Adjunct Professor of Ecology
Environmental Law Center
Vermont Law School

Testimony of the Vermont Lung Association before the Senate Committee on the Environment and Public Works

Re: Reauthorization of the Clean Air Act, Interstate Transport of Air Pollution

June 30, 1981

Prepared and presented by Margaret Bowers, Volunteer Coordinator of Clean Air Activities

The Vermont Lung Association wishes to thank Senator Stafford for calling this hearing and giving us the opportunity to present testimony on the interstate transport of air pollution to Vermont.

We are here today to speak on behalf of, not only our fifty-five thousand supporters, but of the half million citizens of our Green Mountain state whose health and lives depend on the purity of the air we breathe. We speak not as a special interest group, for the quality of air cannot be considered a special interest. Indeed, it cannot be considered apart from the quality of life itself.

We in Vermont are proud of our reputation for exceptionally clean air and our pristine environment. A Vermonter once claimed the air here is so pure as to have "barely been breathed twice." While that may be a slight overstatement, it is true that our air historically has been among the purest in the nation, and our commitment to it, the strongest.

Our state Air Quality Program began in 1968 when our first air pollution control law was enacted. Since then, our consistent commitment and hard work, aided since 1970 by the mandates of the Clean Air Act, have brought nearly all major stationary pollution sources within the state into compliance with emission control standards. Industrial pollution controls have been installed, dirty fuels replaced with cleaner burning ones, and open burning banned. Clearly, we have demonstrated our determination to maintain a healthful environment. It is no accident that our air is among the cleanest in the nation.

Of great concern to us now, however, are the poisons carried here in the atmosphere from industrial states south and west of us — poisons that threaten not only our way of life, but life itself. We all have heard the great and justified outcry evoked by the visible effects of acid rain on our lakes, fish, and vegetation. Now we must focus on the silent, invisible threat of those same sulfates to human health — our health, and that of our children and our neighbors.

When sulfates in the atmosphere are not being dissolved in rain or snow and falling to the earth as sulphuric acid, they are falling through the air as fine, respirable particles. Sulfate particles are extremely tiny —.1 to 1 micron in size. As such, when they are breathed in, they can bypass the upper respiratory tract, which traps larger types of airborne particulates. The sulfate particles travel deep into the lungs where they can become trapped and aggravate the symptoms of respiratory disease, increase acute lower respiratory distress, and affect the respiratory function of children.

There is no national standard to control this fall of sulfate particles. Fine particles elude control by the Total Suspended Particulate standard because that standard is based on weight, but sulfate particles are extremely toxic -- ten to one hundred times more so than equivalent amounts of sulfur dioxide.

Sulfate concentrations in Vermont constitute fifty percent of our fine particulate pollution, on the average, and at times they reach seventy-five percent. Yet Vermont has the lowest sulphur dioxide emissions of any state east of the Mississippi.

According to the Vermont Agency of Environmental Conservation, thirty-seven per cent of Total Suspended Particulate pollution in Vermont and forty-five percent of fine respirable particles travel here from the smokestacks of other states.

Since 1970, the EPA, working under the Clean Air Act, has tried to reduce sulphur dioxide emissions by requiring users of high sulphur fuels to install controls. One so-called control method, used by many large polluters, was taller smokestacks. By the time sulphur dioxide released from those stacks reaches the Northeast, it has undergone complex chemical changes and is transformed to the more toxic sulfate particles, or to acid rain.

The Vermont Lung Association opposes the use of tall stacks as a primary method to attain air quality standards in any region.

Further, we are calling on Congress to assign a high priority to the sister problems of acid rain and the fall of sulfate particles when considering strategies for dealing with the interstate transport of air pollution.

The VLA believes there is an urgent need for development of a National Ambient Air Quality Standard for fine particles. The EPA should rapidly expand the research program in health effects of fine particles to support the standard setting process.

In setting those standards, and in reauthorizing the Act to maintain those already set, we urge the Congress to retain the health basis for primary standards, and to vigorously reject all attempts to introduce consideration of the cost of control into the standard setting process. There is no rational alternative, for these reasons:

A true cost/benefit analysis would have to compare the benefits of a healthier, more vigorous, population having less absenteeism from work or school and fewer health care expenses to a society in which some people are allowed to suffer breathing impairment, chronic illnesses, and even premature death to enhance the profits of an industry or slightly lower the cost of a product to consumers.

A true cost/benefit analysis must hang a price tag on a pregnant woman's ability to give birth to a live child; on a two-year-old child's prospects for growing into healthy manhood; or on the ability of a fifty year old worker with asthma to keep working.

A true cost/benefit analysis would, in fact, require a price to be set on human life. Unless Congress is willing to set such a price, that analysis is impossible.

The Vermont Lung Association urges Congress to consider costs to business and industry in the development of control strategies and the streamlining, wherever possible, of the process for meeting standards, but not in the setting of standards.

The burden of paying for the disposal of wastes from industry cannot be removed by legislation; it can only be shifted. Either industry will pay for the clean disposal of its own wastes, making that expense a fair part of its price to consumers, or citizens will involuntarily pay for pollution with their health, their health-care dollars, and some will pay with their lives. The burden then will fall most heavily on those least able to control it: unborn and very young children, the elderly, and the chronically ill.

Air pollution is a factor in the development of our three major killers in Vermont as well as nation-wide: heart disease, cancer, and lung disease. Lung disease alone kills more than three times as many Vermonters each year as all motor vehicle accidents. In addition, more than half of our infant deaths are related to respiratory disorders.

Unlike most other health risks in our society, air pollution offers no choice. We must breathe the air. The only way we can manage this risk is through our government. We are thankful for a government which has traditionally placed the right of the people to health and safety above the desire of anyone for financial gain.

In addition to requiring air quality standards for certain pollutants, the Clean Air Act authorizes the EPA to set emissions limits on hazardous air pollutants for which there are not standards but which could cause death or serious illness. Of the hundreds of hazardous substances emitted into the air, the EPA has so far issued standards for four. The Vermont Lung Association believes the Clean Air Act should speed EPA's setting of emission limits and issuance of standards.

Finally, standards are useless without meaningful deadlines and penalties. Therefore, the Vermont Lung Association supports the retention of deadlines for attaining the National Ambient Air Quality Standards now contained in the Clean Air Act. We further support strengthening the EPA's enforcement authority, and economic disincentives such as non-compliance penalties, excess emissions charges, and economic sanctions.

The Clean Air Act already has saved many lives. It must continue to be strong and to meet the new challenges of the eighties.

The Vermont Lung Association believes the protection of public health is a basic responsibility of government. We are calling upon our elected representatives in Congress to meet that responsibility with strength and honor.

VERMONT LUNG ASSOCIATION SUMMARY OF RECOMMENDATIONS

CONGRESS SHOULD ASSIGN A HIGH PRIORITY TO THE SISTER PROBLEMS OF ACID RAIN AND THE FALL OF SULFATE PARTICLES WHEN CONSIDERING STRATEGIES FOR DEALING WITH THE INTERSTATE TRANSPORT OF AIR POLLUTION.

NATIONAL AMBIENT AIR QUALITY STANDARDS SHOULD BE DEVELOPED FOR FINE PARTICLES. THE ENVIRONMENTAL PROTECTION AGENCY SHOULD RAPIDLY EXPAND THE RESEARCH PROGRAM IN HEALTH EFFECTS OF FINE PARTICLES TO EXPAND THE STANDARD SETTING PROCESS.

THE HEALTH BASIS FOR SETTING STANDARDS SHOULD BE MAINTAINED. ALL ATTEMPTS TO INTRODUCE THE CONSIDERATION OF COSTS INTO THE STANDARD SETTING PROCESS SHOULD BE VIGOROUSLY REJECTED.

THE CLEAN AIR ACT SHOULD SPEED THE ENVIRONMENTAL PROTECTION AGENCY'S SETTING OF EMISSIONS LIMITS AND ISSUANCE OF STANDARDS FOR HAZARDOUS SUBSTANCES.

DEADLINES FOR ATTAINING THE NATIONAL AMBIENT AIR QUALITY STANDARDS NOW CONTAINED IN THE ACT SHOULD BE RETAINED.

THE ENVIRONMENTAL PROTECTION AGENCY'S ENFORCEMENT AUTHORITY SHOULD BE STRENGTHENED. WE SUPPORT ECONOMIC DISINCENTIVES SUCH AS NON-COMPLIANCE PENALTIES, EXCESS EMISSIONS CHARGES, AND ECONOMIC SANCTIONS.

WE OPPOSE THE USE OF TALL STACKS AS A PRIMARY METHOD TO ATTAIN AIR QUALITY STANDARDS IN ANY REGION.

VETERANS ADMINISTRATION HOSPITAL
WHITE RIVER JUNCTION, VERMONT 05001 (802) 295-9363
A Component of the Dartmouth - Hitchcock Medical Center

1797

DEPARTMENT OF MEDICINE

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STANT CHIEF
ER G. FREY III, M.D.

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DERMATOLOGY
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ONCOLOGY
JOSEPH F. O'DONNELL, M.D.

PULMONARY
JOSEPH L. GRANT, M.D.

RHEUMATOLOGY INFECTIOUS DISEASES
THOMAS H. TAYLOR, M.D.

BOX 285 NORWICH VT 05055
JUNE 30, 1981.

DEAR SENATOR STAFFORD,

ONE WAY OR ANOTHER, SUFFERERS FROM LUNG DISEASES HAVE HAD HAVOC WREAKED ON THEIR LUNGS. THEIR DISEASE DEPRIVES THEM OF OXYGEN THEY NEED TO BREATHE. ERY EFFORT WE MAKE TO CLEAN UP VERMONT AIR BENEFITS THEM DIRECTLY.

VERY TRULY YOURS

Joseph L. Grant
JOSEPH L. GRANT

CHIEF, PULMONARY SECTION
VA HOSPITAL WHITE RIVER JCT.
REPRESENTATIVE COUNCILLOR (N.H. + VT), AM. THORACIC SOCIETY
DIRECTOR AND PAST PRESIDENT, VT. LUNG ASSOCIATION

STATEMENT PRESENTED AT PUBLIC HEARING ON REAUTHORIZATION OF 1977 CLEAN AIR ACT, AT RANDOLPH, VERMONT, JUNE 20, 1981.
CHAIRMAN: SENATOR ROBERT STAFFORD

I am Margaret Gutelius-Watt, M.D., retired and living in Ely, Vermont, for the past 10 years. Before retirement I was Associate Professor of Pediatrics at George Washington School of Medicine in Washington, D.C., and Director of the Child Health Center, a clinic for teaching and research, at Children's Hospital of the District of Columbia.

My involvement with the problems of air pollution began in the mid-1970's when this subject was my field for continuing study as a member of the Norwich League of Women Voters. The interest has continued for me - now in my third year as energy coordinator for the town of Fairlee.

It is my firm belief that the Clean Air Act should be strengthened, not weakened in any way. I believe, furthermore, that this is the desire of the common people of this country - when not terrified at the threat of short-term economic hardship.

My health concerns are as follows:

We must continue and improve our protection for the health of those groups at greatest risk, namely: infants, children, senior citizens, those with respiratory problems and some other diseases. I also think that we should add to these groups the urban poor. They suffer unduly from the usual environmental problems, but especially from foul air. Urban areas are not as yet meeting the standards for the four pollutants set by the Clean Air Act of 1977.

I shudder at the materialistic culture which would put a dollar value on protection of human life and health. We should not be lead astray by our new leader, EPA Chief Anne Gorsuch, and her concern for relative cost benefits in societal goals.

As for the long-range fallout of sulfates and nitrates and other poisons, it seems only sensible to control all possible sources in North America, not just the specific areas believed to be at fault. Also long-range fallout is ~~also~~ a direct health hazard to humans, not just a blight to our lakes, forests and soil.

A firm crackdown is long overdue on the automotive industry in the matter of car emissions. They have been draging their feet for years. Diesel motors must be included.

Of course, standards (national) for all known and dangerous pollutants must be rushed through research laboratories. The especially dangerous "fine" particulates demand immediate action.

I especially would like to protect our so-called clean air in Vermont from significant deterioration, no matter how complicated the procedure. After all the whole state is a scenic area and devoted to recreation and tourism.

Margaret Gutelius-Watt

CLEAN AIR ACT OVERSIGHT

WEDNESDAY, JULY 1, 1981

U.S. Senate,
Committee on Environment and Public Works,
Albany, N.Y.

The committee met at 10 a.m., in the assembly hall, campus center, State University of New York at Albany, 1400 Washington Ave., Albany, N.Y., Hon. Daniel P. Moynihan, presiding.

Present: Senator Moynihan.

Also present: Congressman James H. Scheuer.

OPENING STATEMENT OF HON. DANIEL PATRICK MOYNIHAN, A U.S. SENATOR FROM THE STATE OF NEW YORK

Senator Moynihan. A cordial good morning to our guests and associates in this enterprise.

This is a formal hearing of the Committee on Environment and Public Works of the U.S. Senate. I am here representing our chairman, Senator Stafford, our neighbor in Vermont, and I am ably assisted by Kathy Cudlipp, who is the majority counsel to the committee, and Suanne Pfifferling of my own staff.

We have with us also Charlen Sturbitts who is with the staff of Senator Mitchell and Curtis Moore, who is assistant counsel to the committee. I would like to make one point at the opening.

We are going to hear a wide range of witnesses and take statements if anyone wishes to submit one. We are going to interrupt our formal hearings, you might say, for a technical inquiry at which occasion we are going to have the very high honor to have with us of members of the government of Ontario, Canadian specialists in the matter. We will hear from the Honorable Keith Norton, who is the Ontario Minister of Environment, and two of his associates.

As we know, the Government of Canada is a wholly distinct and sovereign entity and would not normally be appearing before a committee such as ours. The provinces are also distinct and sovereign entities. So they wouldn't be able to be present.

These gentlemen are present as our guests. It is a mark of the seriousness with which this matter of acid rain, is taken in Canada that so distinguished a company should come down for this purpose.

I want to make it clear at the outset that in the view of this member of the committee, and I think the committee shares this view that acid rain is a problem which we share with Canada, and which we will only be able to manage if we manage it together.

This issue unites us in adversity.

The lakes of our mountains are dying. The wildlife is disappearing from the lower Canadian regions, as well as from the higher Adirondack regions. Acid precipitation is dangerous not only to the health of fish and animals, but it may pose a danger to the human species as well.

Our hearing today takes place in an atmosphere of concern in Washington, because word has leaked out that a draft bill to replace the Clean Air Act has been prepared by the administration. It is a measure, very simply, that would dismantle the efforts that have been put in place over 17 years since the original clean air legislation was passed in 1963, the results of which are so impressive that no one who can be in an American city today would not know them.

The clean air efforts have worked, because we have worked at them.

At this point, for the administration to come along and say, "Let's get rid of them because they work," seems to me a very curious logic.

I think that may be said to be the view of Congressman Scheuer, but I will let him speak for himself.

To begin our hearing today, we are honored to have the chairman of the Subcommittee on Natural Resources, Agricultural Research, and Environment of the House of Representatives, New York's distinguished Congressman, Mr. James Scheuer.

Mr. Chairman, I wonder if we could ask you in the colleaguelike manner of the House, to appear before your brothers in the Senate and state your views? We welcome you.

STATEMENT OF HON. JAMES SCHEUER, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW YORK

Mr. SCHEUER. Thank you very much, Mr. Chairman. I am very honored to be invited to participate in these hearings. I think you are absolutely right. The timing of these hearings comes at a historic point in time when the American Government is going through a change and we are abandoning, apparently, abandoning, at least on the administration side, long-held concerns with the environment and the quality of life with the compassionate range, the full length and breadth of this structure that has been erected brick by brick over the last 49 years, since 1932, dealing with every aspect of human welfare, the support system that has been established for the very young, the very old, the infirm, the sick, the disabled, the poor.

It has not been taken away brick by brick. It is being taken apart with a record fall and the juggernaut of mindless bulldozers. It is a tragic process.

The process by which it has been taken apart is even more appalling. The substance of what has happened; the sheer abdication on the part of the House of legislative powers to the executive branch, unparalleled in our history.

So we come here at a time of great crisis in our Government, as well as a time of mounting crisis in our environment.

Mr. Chairman, I come here today, and I speak now not as an expert witness. I come as a colleague of yours, and in the Congress as one who is very concerned and who has been involved in this matter.

I hope to learn with you. I look forward to sitting next to you and hearing from this very distinguished array of witnesses.

I think we do know enough to know that this is, the problem of acid rain, is one of monumental importance within the United States that is pitted region against region, and without the United States that is pitted country against country.

Until we set up a far more sophisticated monitoring system than we have now as between regions of our country and acid rain flows that cross boundaries, until we have some kind of orderly, disciplined way of checking aggressor regions with victim regions, assessing the costs of cleaning it up and the benefits of cleaning it up and have some kind of plan, structured plan, for dealing with this problem, we are going to continue to poison the atmosphere. Not only does acid rain poison lakes and fields and forests and perhaps humans, too, but it has poisoned the political environment as well.

New York State is suing the Environmental Protection Agency to order them to turn down applications for 17 industrial plants in the Ohio River Valley. The United States has found out, as I found out in a recent conference of parliamentarians in Halifax in Nova Scotia, that the Canadians are absolutely enraged and angered and offended at the flows of acid precipitation that has come across her border. The Swedes are absolutely outraged at what has been done to the environment of Sweden and other parts of Scandinavia from emissions that are emanating day by day, week by week, month by month, from England, France, Germany, and Belgium.

I made a trip of all of those countries just a few weeks ago with Congressman Udall, Morris Udall, the chairman of our Interior Committee, who also has jurisdiction over the environment, and we found very little disposition in England, and France, and Germany to take the concrete, costly measures that will need to be taken to manage this problem to free Scandinavia from the blighting effects of this flow that goes because the prevailing winds in Europe go from south to north, this constant flow of poisonous emissions that come from southern Europe.

ICE, the International Community of Europe, has never faced a problem of the order of magnitude, the importance, of acid rain.

The costs transnationally and nationally are enormous, and our own country, in our own region here in the Adirondacks, approximately 10 percent of the lakes in the Adirondacks have such a high rate of acidity that fish life has disappeared.

Another 9 or 10 percent of the lakes are threatened. We are suffering over $1 billion a year in damage to structures, to buildings, to paint, to construction of materials, monuments. We are suffering something like $2 billion a year in crop loss in this country and forest loss.

In Canada, the results are comparable. I was in Nova Scotia a couple of weeks ago in Halifax at a conference of parliamentarians. We heard the same pitiful, disgraceful story of the destruction of the environment, destruction of the forest industry, degradation of the forestry—which, of course, is more important to the Canadians than it is to us because the forest industry and forest products form a far higher percentage of their enployment and of their GNP than it does with us.

It goes to approximately 15 percent of their GNP. They have had visible degradation of their forest industry.

The health effects are somewhat less easily identifiable. I hope the witnesses will help us identify the health effects. It seems that the very young and the very old are more inclined to suffer pulmonary effects than the general population. It seems that the dry acid particulates have a more urgent effect on human health than acid rain itself.

Again, it is hard to quantify. It is expected that we are to spend on the order of $300 billion in the next 5, or 6, or 7 years before the end of the eighties in coping with this matter.

It may be that we will spend more. I think that there is no greater challenge to us than getting the scientific community to give us a better, more finely tuned research base than we have now to measure costs and benefits.

We don't know whether, if you have a given percentage in particulate emissions, you will have a consequent cause-and-effect reduction in the harmful effects. We don't know if you reduce the degrading emissions by 50 percent whether you will have a 50-percent, or a 20-percent, or an 80-percent reduction in the degrading effects.

There are those who tell us that we ought to concentrate more on the quality of indoor air. There are those who tell us that we spend 90 to 95 percent of our time indoors and that formaldehyde and radiation radon have a far more degrading effect healthwise than the sulfur dioxide and the other emissions that come from stationary energy users, the utilities, the automobiles, and so forth.

So there is a great deal that we don't know. There is a great deal that must be done to improve our scientific base. I fear that the inadequacy of our scientific data base is going to give grips to those who would say: "We can't regulate now; we don't know enough."

Well, the Reagan administration has been telling us that we shouldn't seek a risk-free society and a risk-free environment. There is no such thing as zero risk in the workplace, in our environment, in our health, in our safety. I would say that that may be true to some extent.

Senator MOYNIHAN. Could I ask you, Mr. Chairman, you would agree there is no such thing as zero risk?

Mr. SCHEUER. I would agree.

Senator MOYNIHAN. But is there any reason to go around poisoning our environment?

Mr. SCHEUER. There is also no such thing as perfect data. There is no such thing as perfect safety. There is no such thing as perfect data. If we wait until we get perfection in our data, we will never get any action at all. Congress has to bite the bullet and understand that there is a problem of devastating seriousness that has accumulated now and take, perhaps, some rough-and-ready remedial actions that at least will begin to help us cope with the problem while we are helping to perfect the data base.

Senator MOYNIHAN. Could I ask you this?

At just the moment when we are assembling the data with respect to acid rain and getting into a working relationship with

Canada in this area, would you think that is the moment the Federal Government should choose to put an end to the regulatory processes which can respond to the problem?

Mr. SCHEUER. Mr. Chairman, our President, in one of his first official visits, went to Canada and met with the Prime Minister and really got dumped on, got a very clear, sharply etched perception of their measurement of the seriousness of acid rain very early in his administration.

For this administration to start tearing apart the whole fabric of legislation that began to help us approach this matter in an orderly, disciplined process, I think can only be described as bizarre and tragic.

We have got to get our act together. It will probably take us 5 years before we have a really serious data base on this, but we can't sit on our back sides for 5 years and do nothing. There are certain basic structural elements that must be set in place to enable us to get a handle on this problem and just as we cannot achieve a zero risk of environment, neither can we achieve a 100-percent-perfect data base before starting everything.

I think the same measure of moderation, the same measure of cost-effectiveness, the same measure of good sense, common sense judgment, poor sense that the Reagan administration calls for in achieving safety in the workplace, and environment, and health, that same moderate judgment and good sense ought to be applied in the first preliminary steps we take, and they are going to be important steps and expensive steps that we take to create a structure of concern and recognition of the fact that we cannot continue to pollute our earth for our neighbors across national borders, as well as for ourselves, while the scientists complete the work that has to be done.

There must be concomitant moves in both areas.

Thank you, Mr. Chairman. I look forward to hearing this.

Senator MOYNIHAN. Thank you, Mr. Chairman. Would you do us the courtesy of joining us here at the table for as much time as you have?

Mr. SCHEUER. I will be very happy to. I will be very happy to.

Senator MOYNIHAN. If I can just make a statement in response to the last point that Chairman Scheuer has made, we are holding this hearing on a university campus. We are doing so to make clear our understanding that these subjects are not fully understood and there is a good deal of work to be done, but it is not in the nature of science to talk about perfect data.

There is no such thing. The great physicist Nils Borg used to tell his classes that: "Look at every statement of fact from me as a question. You, in the end, deal with probabilities and probabilities are never finite." We know enough already to know how serious a problem we have. We know fundamental first steps and to have this enterprise suddenly assaulted by the very Government that commenced it makes little sense.

We are honored to have our Governor with us this morning, and he is to testify with his former colleague, Mr. Scheuer. I wonder if you could do us the honor of coming forward at this point.

Senator MOYNIHAN. We have a statement from Senator D'Amato which will be made a part of the record at this point.

[The statement follows:]

July 1, 1981

STATEMENT
BY
SENATOR ALFONSE D'AMATO
ON THE
CLEAN AIR ACT
ALBANY, NEW YORK

I commend Senator Moynihan for holding these hearings on the Clean Air Act and the growing problem of acid rain. New York is fortunate to have him as a Member of the Senate Environment and Public Works Committee as it considers the reauthorization of the Clean Air Act. It is essential that our part of the country, because of its special environment and related problems, have its views incorporated in the most important piece of environmental legislation.

The Clean Air Act has been Congress' response to deteriorating air quality as a result of the growth of American industrialization and dependence on the automobile. In fact, passage of the Act in 1970 was the beginning of an effort to turn back the clock on environmental degredation. The Act has met with mixed success. While increases in air pollution since 1970 have leveled off and several pollutants have begun to decline, air pollution levels in many regions still exceed standards originally to have been achieved in 1975. One difficult problem has been the continuing inadequacy of information about air pollution sources, processes, and remedies. Another obstacle has been the complicated procedural requirements of the Act, resulting in a forbidding maze of permit requirements. Yet a third problem has been heightened concern about the impact of air pollution control programs on other important national goals, particularly economic growth and on energy development.

Nevertheless, I support the reauthorization of the Act and believe that we in Congress must approach any revision of it with a scalpel, not an ax. A balance can and must be struck between the goals of improved air quality and reduced federal regulatory intervention in the lives of our people. A balance can and must be reached between not allowing air to deteriorate in designated areas and increasing economic growth and vitality. A balance can and must be accomplished between creating a healthy environment and increasing the accuracy and dependability of the scientific data upon which the Act is based. In so doing, however, we cannot sacrifice the health of Americans.

I believe that most Americans support these goals. Recent nationwide polls on the quality of the environment show that 75 percent of Americans believe it is possible to maintain strong economic growth in the United States and still maintain high environmental standards. Nearly 60 percent believe that government regulations and requirements to protect the environment are worth the extra costs added to the products and services the average person buys. However, at the same time, Americans support relaxing clean-air requirements to permit industry to burn more coal rather than imported oil.

The Congress must address the problem of acid deposition in the reauthorization of the Clean Air Act. I am concerned with recent studies claiming that acid rain and snowfall have wiped out all the fish and many plants in 50 percent of the high mountain lakes in our own Adirondack Mountains. These same studies have concluded that 10 percent of the lakes in the entire U.S. Adirondack region are now "dead", with fish and plants having been replaced by acid-tolerant mats of algae. We must also take into consideration the international ramifications of this problem, as our relations with our Canadian neighbors can only be improved by addressing this problem with the serious attention it merits. Nevertheless, in dealing with the problem of acid precipitation, Congress must be careful not to rush to adopt more stringent regulations without the scientific basis on which to do so. In the past, the Federal government has moved all too swiftly to regulate without a proper understanding of the problem it seeks to control.

I also suggest that we in Congress must take a greater role in addressing the problems of air quality. To as great a degree as we possibly can, and in cooperation with the States, we must spell out for the enforcing Federal agencies what we mean when we pass a law. In the past decade it seems that Congress has been set on writing a book on many of our environmental problems, but only gets as far as choosing a title and chapters, leaving the Federal agencies to fill in most of the lines. Congress must reassert the legislative authority which is properly ours, and leave enforcement of its laws to the Agencies. We have yet to vote in this country for the Environmental Protection Agency Administrator or his deputies.

In all our efforts, we must remain cognizant of the importance of air quality to our health. In closing, let me quote Dr. William Stewart, testifying before the Senate's pollution subcommittee in 1967: "Today, thanks to many advances in protecting people against disease, we are able in the health professions to think about the positive face of health -- the quality of individual living....Being healthy is not just being unsick....In controlling air pollution for the benefit of health, we are working toward an environment that is not only safe, but conducive to good living."

Senator MOYNIHAN. Good morning, Governor. Welcome to this committee.

STATEMENT OF HON. HUGH L. CAREY, GOVERNOR, STATE OF NEW YORK

Governor CAREY. Good morning Mr. Chairman, Congressman Scheuer. I do want to thank you, Senator, and the committee for this opportunity to present New York State's view on amending the Clean Air Act.

The Clean Air Act of 1970 was originally adopted to assist all areas of the country in achieving and maintaining clean air.

I was a strong supporter—and I am—I was a strong supporter of that effort while I was a Member of the House. Today, however, the act adopted in 1970, and amended in 1977, and again in 1978 by your actions, must be strengthened to make it more responsive to the environmental and economic realities that now confront us.

Briefly, let me outline for your committee some of the broad modifications we are seeking. I will then defer to Commissioner Robert Flacke, the State's Environmental Conservation Commissioner, who will explain the details of our proposed changes.

First, the Clean Air Act fails to address the critical issue of the long-range transport of pollutants. One form of air pollution, acid rain, has resulted in the destruction of some 264 Adirondack lakes and ponds which no longer support sport fish populations. The water has turned to acid in 264 of our precious lakes. We here in New York have long recognized the harm that acid rain has caused and will continue to cause to our lakes, rivers, soils, and vegetation.

Early last year, New York organized a coalition of Northeastern States, each one sharing our concern over the long-range transport issue. I might amend that by saying not just Northeastern States. We had our friends from Georgia and Alabama, likewise concerned about the acid stream coming toward them from Dallas, Tex., and elsewhere in the Southwest.

It is not quite accurate to say the Northeast only. Our friends of the eastern seaboard had like concerns.

The coalition, led by our Bob Flacke, met with Environmental Protection Agency officials to plead the Northeast's case against acid rain. These Federal officials promised action, but they have delivered only rhetoric and excuses. Now I am calling on Governors from the Northeast and my friends from the Southeast, the Midwest, New England, and Mid-Atlantic States to meet and develop a comprehensive agenda of environmental issues that are of immediate concern to all of us.

I hope to arrange that meeting this fall and invite you and your fellow committee members to join with us at this meeting.

I might say that we had attempted to hold the meeting earlier, and we had a preliminary get-together the day following the Reagan inaugural for our Governors committee on this point, but intervening events, Congress, Governors running to and fro to prevent the impact of the Reagan budget from assaulting their States enormously, made that impossible.

We will meet in the fall. We will examine proposals to require all coal above 3-percent sulfur be cleaned before burning; to accelerate research on acid rain; and to encourage the use of low-nitrogen-oxide-forming burners by utilities.

New York will continue to argue its case before committees such as your distinguished committee, in other public forums and, if necessary, through the courts. We are seeking equity and consistency in administration of the Clean Air Act. We believe the Congress is the proper forum for addressing this issue. New York is also concerned with other aspects of the current act which we believe must be modified.

For example, we believe the act must be adopted to help us achieve our energy goals. Our continuing efforts to reduce reliance on costly foreign oil has sparked a unified effort to convert many of New York's oil-burning generating plants to coal-fired units. Yet a host of administrative and bureaucratic roadblocks, primarily on the Federal level, are creating unnecessary difficulties, and delays, and unnecessary costs.

Both procedurally and substantially, the current act makes conversion to alternate energy sources such as coal and wood difficult, if not impossible.

Accordingly, the revision process should be changed to allow New York to provide its plan to protect air quality without being subjected to current time consuming, and costly, and burdensome requirements for EPA approval.

For example, the so-called prevention of significant deterioration requirements have become a fornidable deterrent to coal conversion, as well as new construction, in our State. We need construction jobs in this area of the State, particularly, at this time, Senator.

The regulations are cumbersome, confusing, restrictive, and expensive. Moreover, delays in obtaining approval for new facilities have been accessible. Although New York State fully supports the concept of protecting wilderness areas and national parks and, indeed, has been a leader in such efforts, accesses in the name of this protection have created many of the problems I have outlined here.

In our State's position paper on the Clean Air Act, copies of which have been supplied to your committee, we have detailed the technical modifications we believe would reduce these cumbersome and excessive regulations while at the same time insuring the maintenance of environmental quality standards.

Our position paper also outlines other important modifications which are critical to a fair and equitable administration under Federal law. These modifications call for: A standard-acting program which would be based on protections against adverse health effects including public health risks, and social, and economic impacts; Federal enforcement, only adequate notice to the State and after the failure of the State to initiate and actively pursue remedial action, eliminating time-consuming contradictory and needless administrative and procedural requirements in the State implementation plan process.

Other specific technical modifications are detailed in our position paper.

As I mentioned earlier, Bob Flacke is here to answer your detailed questions pertaining to the technicalities of our proposal.

Finally, again, I want to take this opportunity to thank you, Senator Moynihan, and the other members of your committee, for coming to Albany, for coming to New York, and listening to those who must deal on a day-to-day basis with these problems. We can, I believe, provide a safe and healthy environment for our citizens and at the same time insure the economic vitality of New York.

Our proposed changes in the Clean Air Act represent a major step in that direction. I applaud you again for bringing together not only people from our State and this region, but to recognize the international substance of this problem and helping with us to help wish Canada on a day of significance, on a day of the celebration of its Union status. This is a great day to be with you.

On the point of recommendations, you and I have spent many days together trying to end abuseful bureaucracy. May I end with a pertinent comment? Maybe we don't need regional EPA?

Senator MOYNIHAN. That is a thought. I will put into the record the State position paper on the Clean Air Act. (See p. 750.)

Let me thank you for your testimony. May I report to you from Washington that at the very moment when we seem to be getting the hang of this kind of legislation and we are beginning to see it work and beginning to see some of the things that have to be done internationally, the administration is coming along with a proposal to just take the whole legislative apparatus apart.

You, as a Governor, can speak to this. In the name of returning power to the States, if we put an end to any national standards, we put an end to any possibility of dealing with acid rain, don't we?

Governor CAREY. Absolutely, because the origin is beyond the control of the State which is afflicted. Therefore, we have to go to the referee. The referee is the Federal Government. If we leave the States to each other, we will wind up in the courts and it will be useless litigation.

Senator MOYNIHAN. It couldn't be more succinctly stated by the Governor of the greatest State of the Union and the second largest

State that there is a role for the Federal Government. If we can't set standards that we all abide by, we will go back to that business of competing economically by degrading our environment. One area will use cheaper, dirtier coal and dump the emissions on somebody else's land or, indeed, country.

Governor CAREY. We would state again, Mr. Chairman, that on the very day after the administration was inaugurated, there was a sense among the Governors that we were getting somewhere, and we weren't seeking a villain; we weren't seeking a victim.

What we tried to do was say that if we can wash the coal at the source and share the cost of the coal washing among all of us, then the clean coal coming to the burning site would have removed from it the acid contaminants. We all share that. That way, West Virginia wouldn't have to blink a little bit because we want to sell coal to Illinois and Ohio and Illinois and Ohio wouldn't say: "We don't want to pay the cost of cleaning ourselves, so we are going to go ahead and burn coal and precipitate acid upon you and your Canadian neighbors."

That is how simple it would seem to be. That can only be worked out by a compact among the State supervised by the Federal Government so we decide what the proportionate share is according to the consumption of the cost of cleaning the coal.

That is how I saw it working in February. We have lost ground since.

If the Federal Government dismantles this act, those who burn coal will look at the economic sides of their States and say, "We won't worry about the acid rain. That is your problem."

Senator MOYNIHAN. That is a very important statement. Let me say to you that while the Senate Committee on Environment and Public Works is in place, this act is not going to be dismantled. I think the same may be said of our counterparts in the House.

Mr. Chairman, would you like to talk to your former colleague here?

Mr. SCHEUER. No; I think our Governor has said it all. I take it, just to be repetitious, that you feel there is a consensus among our Governors of the country that they don't want this problem dumped back to the States? Since it is a regional problem, and a national problem and an international problem, the States independently are not capable of handling it.

I don't want to put words in your mouth. Is there some contention among the Governors that they don't want this to be relegated to the jurisdiction of States alone?

Governor CAREY. As Governor Matheson of Utah, the Governor of Arizona or the western Governors, southern Governors, all of us, I believe, with a voice, want the Clean Air Act standards maintained, and we want to see the enforcement of the act, not harshly, but looking at the economic consequences of the need to burn the coal; share those economic burdens among all of us so that coal replaces oil and clean air replaces acid rain.

Senator MOYNIHAN. Isn't it correct that if you were to wash the Ohio coal with the more than 3-percent sulfur content you would get rid of about a quarter to a third of the sulfur dioxide emissions?

Governor CAREY. Yes; we would.

The alternative is that you have to put in the kind of equipment in the stacks to remove the contaminants instead of cleaning them before the coal is burned.

What that does in this State is gather enough sulfur and other contaminants to where we have to have a pile going from probably Tug Hill down to Binghampton and have no place to put it.

Senator MOYNIHAN. Have you ever thought of building the world's biggest fan, maybe 5 miles high and pointing it at Ohio.

Governor, thank you very much, indeed. I wonder if I could recess the hearing just for a moment so that the Governor might have a chance to say hello to Minister Norton. I will just recess for 20 seconds.

[Brief recess.]

Senator MOYNIHAN. We now will begin the technical panel which consists of our friends from the Dominion of Canada. On Dominion Day, we welcome to the table the Honorable Keith Norton, the Minister of Environment. You have others with you, if they would like to come forward. Would you introduce them, Mr. Minister?

Also Dr. McLean is going to join you. Dr. McLean is the head of the DOMTAR Research Center in Quebec, if you would please come forward, and Mr. Michael Perley of the Canadian Coalition on Acid Rain.

Mr. Minister, this is a distinct honor to this committee to have you here. It is a great courtesy of you to come and offer your advice. To do so on Dominion Day suggests a commitment that is beyond any normal commitment.

It must be a very serious matter to you, indeed. This committee is grateful to you and your colleagues for being willing to help us out on the technical matters in which you are expert.

The committee is yours.

STATEMENTS OF HON. KEITH NORTON, MINISTER OF ENVIRONMENT, PROVINCE OF ONTARIO, ONTARIO, CANADA; GREG VAN VOLKENBURGH, DIRECTOR, AIR RESEARCH BRANCH, MINISTRY OF THE ENVIRONMENT, PROVINCE OF ONTARIO, ONTARIO, CANADA; TOM BRYDGES, SUPERVISOR, LIMINOLOGY AND TOXICITY SECTION OF THE WATER RESOURCES BRANCH, MINISTRY OF ENVIRONMENT, PROVINCE OF ONTARIO, ONTARIO, CANADA; RONALD McLEAN, DOMTAR RESEARCH CENTER, QUEBEC, CANADA; AND MICHAEL PERLEY, CANADIAN COALITION ON ACID RAIN, ONTARIO, CANADA.

Minister NORTON. Senator Moynihan and Congressman Scheuer, I would like to express our appreciation to you for making it possible for us to appear before you today and to share with you our concern and some of our knowledge in a field of great common interest to us.

I think I need not say that traditionally, your country and mine have functioned as good neighbors in such a way as perhaps is historically unique in this world. The goodwill upon which that relationship has been based has enabled us to work out our mutual problems in the past. It is in the spirit of that cooperation that I have taken an unusual step of appearing here today to put forward Ontario's position and to offer the benefit of our experience and knowledge about the environmental problem that we share: that of transboundary air pollution.

The matter under consideration is the review of the regulatory framework under which the Environmental Protection Agency functions on this issue, the Clean Air Act. We are concerned that the current thinking of the administration supports steps which would result in increased air pollutant emissions through relaxed regulatory standards.

We can only view this apparent direction with the greatest of concern and even alarm. For the transboundary air pollution phenomenon is not guided by any respect for any interstate boundaries, nor, indeed, international boundaries. In such circumstances, air pollution standards cannot meaningfully address the problem if considered solely on a domestic basis.

Dr. Gregg Van Volkenburgh, Director of Environment, Ontario's air resources branch will examine the transboundary nature of long-range air pollution.

Another major concern arises from the demonstrable effects of that transboundary pollution, whether it be acid rain, oxidants, heavy metals, or organic compounds. Simply put, the environments of Ontario and the northeastern United States cannot continue to accept the current levels of air pollution produced today, let alone tolerate any increases.

Literally thousands of sensitive lakes and streams are in jeopardy today from the effects of acid rain. The fish populations and the viable tourist and recreational economies which depend on them are being severely and perhaps irreparably damaged now.

Dr. Tom Brydges, supervisor of the limnology section of my ministry's water resources branch will provide you with examples of this.

We all share a common airshed. And with that sharing comes a joint responsibility. Both countries have duly recognized this principle in the past. In 1972 we both adopted principle 21 of the Stockholm Declaration of the Human Environment which says each country has a responsibility to insure that action within its boundaries do not harm other countries. This principle was again confirmed when our two countries signed the United Nations convention on Long-Range Transboundary Air Pollution in 1979.

The decision in the celebrated Trail Smelter Arbitration states as follows:

> Under the principles of international law, as well as the law of the United States, no state has the right to use or permit the use of its territory in such manner as to cause injury by fumes in or to the territory of another or the properties or persons therein, when the case is of serious consequence and the injury is established by clear and convincing evidence.

The American legislators who enacted section 115 of your Clean Air Act in its original form in 1970, clearly recognized this international responsibility. Their foresight is to be commended. In 1977, the Congress of the United States recognized the increasing severity of the problem by amending the provision to make it even more effective.

In December, Canada responded to this by amending our Federal Clean Air Act which allows Canada to set source specific emission standards to stop environmental damage to another country. The former Administrator of your Environmental Protection Agency said in January, "This legislation enables Canada to give the United States essentially the same rights as section 115 gives to Canadians."

Senator MOYNIHAN. Mr. Costle?

Minister NORTON. Yes. Although this provision has yet to be tested, it clearly rests on one key component: to be effective it must be a dependable legal mechanism available in each country so that the other jurisdiction has a means to enforce the necessary actions for its protection.

The latest affirmation of our international responsibility occurred in August of last year when your country and mine signed a memorandum of intent under which both parties agreed to enforce existing regulations to control emission sources.

If these international commitments are to be met, then the respective decisionmakers and the agencies who set and enforce standards must be prepared to translate the commendable prose into concrete actions.

In Canada, Provincial governments have the day-to-day authority for setting and enforcing pollution standards. For our part, Ontario has pledged full support for our Federal Government's international commitments.

But we have done more than that. We demonstrated our commitment by taking steps in our regulatory and abatement program to curtail our contribution to the problem. And make no mistake about it, we recognize Ontario sources have contributed and still do contribute to the North American air pollution problem.

We have acted to clean up our own backyard even though we recognize that such actions will not solve Ontario's problems. Over two-thirds of the acid rain and other damaging pollutants we receive come from sources south of our border. Your Northeastern States have a similar problem. Nevertheless, we decided to attempt to take the lead role in abatement.

The first step was Inco, Limited, the smelting operation in Sudbury, which respresents the largest single point source of sulphur emissions in North America.

Inco had cut its emissions in one-half during the 1970's. But in May 1980, armed with the knowledge that tougher controls were needed, we ordered Inco to cut back a further 25 percent by the end of 1982.

But these controls are only the first step. Our goal is to reach the lowest level it is possible to achieve technically and economically. Studies undertaken by a joint Federal-Provincial task force in our country will give us the basis for the solution to accomplish this.

Senator MOYNIHAN. Mr. Minister, may I just interrupt to ask you if Inco is International Nickel?

Minister NORTON. That is correct.

Senator MOYNIHAN. Yes; that is the largest simple source sulfur emissions in North America.

Minister NORTON. That is correct, although I must say they have made very significant progress in trying to bring about a change in that.

Our second step was with Ontario Hydro, a crown corporation which supplies almost all of Ontario's electrical energy. Its coal-fired plants together form the second largest source of sulfur dioxide in the Province. In January of this year, we required the utility to immediately undertake control activities which will cost it over $500 million.

The size of Hydro's facilities and the complexity of the steps to be taken mean that considerable lead time is required before the controls are fully implemented. However, by 1990, emissions will have been reduced by approximately 43 percent from current average levels. This applies regardless of any increase in electrical demand.

We are also exploring a new operating philosophy, one which can result in emission reductions without the need for additional abatement equipment called LEDS for the Least Emissions Dispatching System, it means that a utility generates power first from its cleanest plants leaving the dirtiest plants to handle excess loads.

As I stated, Ontario is a contributor to the long-range transport problem. But our Province is committed to living up to the international commitments pledged by our Federal Government.

Each one of us, each country, each State, each Province must be prepared to do its part within its own authority to control its own sources of air pollution.

Ontario is not attempting to tell you how you should go about setting up your regulatory framework on pollution control, I assure you. That is your responsibility, and that is your business.

However, in examining the Clean Air Act, we believe there is a need to rethink the current regulatory mechanisms dealing with industrial pollutants and to consider several issues: (a) Multiple versus single point sources, (b) long-range as well as short-range transport, (c) the connection between primary and secondary pollutants, and (d) transboundary pollution.

Most importantly, setting standards which affect our airshed must be done with international as well as domestic, or local, effects in mind.

Some argue that the reduction of emissions to control long-range transport such as acid rain is an excellent qoal, but that we should wait until all the research has been completed before embarking on our control programs. I would like to say that Ontario emphatically disagrees.

At some point it becomes necessary for governments to take action on the best evidence available without waiting until all of these scientific questions have been answered to the satisfaction of everyone. Let me take an example: More than a decade ago, it became widely recognized that phosphorus loadings were causing severe stress in our Great Lakes. Had a decision been taken to postpone corrective action until all the scientific questions would have been answered, we would still be waiting today.

Instead, we have seen a steady improvement and recovery in those lakes, directly attributable to the control measures that were implemented cooperatively between our two countries. The issue of long-range transport, especially the problem of acid rain, is very similar. We can no more neglect it now than we could have neglected the lakes 10 years ago.

In conclusion, I would urge you to carry our message to your Senate colleagues, to your constituents, and to your administration.

It is a message from the people and the Government of Ontario, and it is simply this: We do care passionately about the damage being done to our lakes and streams, and to our aquatic life. We are deeply concerned about the potential threat to our crops, our forests, and even to human health. We know the American people feel the same way about damaqe to their environment. We are prepared to pay the price to protect our shared environment because a solution is possible, and we feel it is worth it.

Ontario is prepared to shoulder our responsibility and take the tough actions that are needed within our jurisdiction. We would urge you and your colleagues to join with us in this quest.

Thank you very much.

Senator MOYNIHAN. Thank you, Mr. Minister.

That was extraordinarily important. Yes, you may applaud. We will recess for 5 seconds while we applaud. [Applause.]

All riqht, we are back in session.

I have several points, sir, the first of which is to say that I am struck by your story of phosphorus loadings in the Great Lakes. The question didn't have any final scientific answers. There has scarcely been a more unscientific statement than: "This is the final scientific answer." Nevertheless we did take steps to deal with the Great Lakes problem, and we have reversed it and we are thankful we did. The same pattern is here with acid rain.

The second thing I want to say is you are quite right. Section 115 of the Clean Air Act Amendments of 1977 give the Administrator of EPA the power to act in a situation where conduct in this country is endangering public health or environmental standards in another country.

It is a responsibility of the Administrator, not just an option, and I for one think that it is clear that we all want to meet that responsibility.

I wonder if we should just go ahead with your colleagues?

Minister NORTON. I would call upon Dr. Greg Van Volkenburgh of the Air Resources Branch.

Senator MOYNIHAN. Doctor, we welcome you, sir. You are the Director of the Air Resources Branch of the Ontario Ministry of the Environment.

STATEMENT OF GREG VAN VOLKENBURGH

Mr. VAN VOLKENBURGH. Right. Thank you, Senator. It is a double privilege for me to be here this morning. As an American citizen residing in Canada, I am pleased to be able to give your committee testimony, and as a resident, I am pleased to be here to make some remarks on atmospheric chemistry, modeling and such, and a bit on damage to the ozone.

In my capacity as the Air Resources Director, I also am serving as a vice chairman of the Memorandum of Intent, Group 2. That is the modeling atmospheric sciences group. I have also served as the Canadian Vice Chairman of group 1, the effects group. I am also a supporting member of the NOI negotiated committee.

I would like to begin this morning by reviewing the emissions of SO_2 and showing you two tables. In table 1, we illustrate how Ontario's control programs have reduced and will continue to reduce our SO_2 emissions. Actually, in the table, the 1990 figures will be significantly lower because of additional control measures which we will be placing on Inco prior to 1985.

In table 2, we show some emissions in the northeastern United States. With the exception of EPA regions I and II, which includes the State of New York and the northeast, there has been little downward trends to date. In the years ahead, there may even be increases in areas such as region V, where powerplant retirement schedules may be stretched out and SIP's may be further relaxed. As scientists in Canada, we are concerned to see our reductions go unmatched and possibly to be negated by U.S. emissions.

Present emissions in this part of the world quite definitely dominate nature. Therefore, we should expect to see some effects on the environment. Weather and atmospheric chemistry can accelerate and enhance these effects. I would like to, in figure 3, show to you in a summary fashion that although chemistry and weather are complex topics, it is possible to draw some conclusions, namely: No. 1, that there are many different mechanisms to transform sulphur dioxide into acid or neutral sulphates; No. 2, that these mechanisms can operate alone or in combination at different times and in different places; No. 3, that while we do not know everything about all the mechanisms, there is a lot of observational data that confirms the fact that SO_2 does routinely get transformed into acids and neutral sulphates, and that on a longer term basis it is possible to approximate this process with confidence; point No. 4, you can say the same thing about nitrogen compounds with slightly less confidence.

Senator MOYNIHAN. Would you help us on the homogeneous/heterogeneous sides of your model here?

Mr. VAN VOLKENBURGH. Yes. The idea of the chart is to illustrate that there are two basic ways that you can react the compounds. Homogeneous means you can react with gaseous materials in the air such as oxidants or organic compounds.

Heterogeneous means to compound the compounds, say, in rain droplets or on the surfaces of particles such as soot or suspended particulate.

In figure 4 I have also tried to schematically illustrate that the phenomenon after deposition, though also complex, lends itself to a reasonable approximation as well. There are wet and dry processes which occur on a local as well as a long-range basis. They, too, occur in a variety of ways.

One of the problems in dealing with long-range transport is that episodes may occur with accompanying damage. The damage to ecosystems can also occur on longer time scales which can be approximated by averaging the atmospheric behavior.

Very graphic evidence of episodes is well documented for Ontario and the northeast by means of satellite and meteorological "back trajectories," and it illustrates conclusively that long-range transport does not respect international or State boundaries.

As an example, I would like to quickly point out one event which took place in February 1979. That is illustrated in figures 5, 6, and 7. You can see in figure 5 on the first day that the air is clean coming up from the cleaner regions of the United States, from the Southeast and the East.

In figure 6, on the 20th of February, you can see that the air is coming from areas where there are high emissions, and on that day, there were very, very high loadings of SO_2 and suspended particulate, not only in Ontario, but in Pennsylvania and in the State of New York, and again on February 21, you see that the air has moved and is now coming from the West, the midwestern United States where the emissions are lower.

On that day, the emissions dropped considerably in all three areas.

Other back trajectory work which Ontario scientists have performed using monitoring sites in remote parts of Ontario show that event after event bring significant amounts of sulfur dioxide sulfates, ozone or acid rain into areas where there are virtually no local emissions to complicate the analysis.

Since long-range transport occurs, how can one assess the longer term damage from areas containing several emitters? In Ontario we have developed an internationally respected long-range transport model. We use this in a guideline manner. Its results, after having been proven out by field data, are employed on an extended basis to gain an understanding of what sources are causing acid rain.

We can also use this model to look at the behavior of sulfur dioxide and the sulfate part of particulate matter. We have used this model as an important element in decisionmaking and in controlling the emissions of sulfur dioxide and nitrogen oxides in order to reduce the loadings in sensitive areas of New York as well as Ontario.

We have also used this model as a guideline to predict what will happen if the sources discussed in EPA's section 126 hearings have their emissions ceilings raised and emit at those new ceilings.

I would like to just take a moment to show you some slides of results that apply to those hearings, just as examples of what these models can do for you.

In table 8, you can see that Ontario and New York and Pennsylvania would experience a significant increase in the predicted wet deposition of sulfur, that is, over in the two right columns on table 8, if the sources were to emit at the new levels. In fact, in the State of New York, there would be over a doubling of wet deposition, and in Pennsylvania there is also a doubling. In Ontario, there is more than a doubling.

If you can move on to table 9, we have tried to show how different areas contribute to the wet deposition of sulfur. Here, we show the 53 sources that were cited by both New York and Pennsylvania in the 126 hearings. We also show the contributions from Sudbury; other parts of Canada; and other United States emitters.

We also have a background contribution in the model which illustrates the fact that sulfur may be due to or coming from global circulation or sources that we cannot account for.

In Ontario we have been controlling sulfur and nitrogen pollution, but there are other forms of pollution such as ozone over which we have virtually no control. Every summer, about 20 percent of the time, our ozone air criteria is exceeded. This causes damage to our crops and property.

The same phenomenon occurs even more so in the United States, and it is estimated that on a yearly basis about $1.8 billion in agricultural damage and $2.5 billion in property damage every year occurs nationally in the United States due to ozone.

Senator **Moynihan**. $1.8 billion to agricultural?

Mr. **Van Volkenburgh**. Yes. That is an estimate which has been given by several different sources. I have submitted a report by a consultant who works at the Boyce-Thompson Institute in Ithaca, N.Y. He has given that estimate.

The figure for property damage comes from the U.S. National Research Council report on ozone.

Senator **Moynihan**. Thank you.

Mr. **Van Volkenburgh**. It is likely that the majority of this damage is probably occurring in the East because agriculture, population and ozone levels themselves are most intense in the East.

It is also likely that these figures are underestimates of the actual damage. That concludes my remarks. I would now like to enable Dr. Brydges to elaborate on some of the damage that is occurring to the aquatic centers.

Senator **Moynihan**. We thank you, Doctor. Hearings are meant to search out as much of the truth as you can handle at any given moment. I think your table 2 is maybe a little more truth than we are ready for.

Those are striking figures. In Region IV, the sulfur dioxide emissions have gone up 50 percent in 13 years.

Thank you very much, Doctor.

Dr. Brydges.

STATEMENT OF TOM BRYDGES

Mr. **Brydges**. My purpose this morning is to give some examples of the references that the Minister made to the actual damage that we are seeing. With any pollution problem ultimately it is, indeed, the effects that drive the need to solve the problem. What I have done is given a series of photographs and some graphics. There is a set of slides which you say, no doubt, look at as part of your travelog sometime at your leisure.

The first picture is actually just a sampling of a lake. In Canada and in the United States, we have some tens of thousands of lakes like that in the Precambrian rock areas which are being affected by acid rain. These lakes support an extensive and unique ecosystem. There are hundreds of species of fish and birds and wildlife. This is really one of the great wilderness areas of the world.

Senator **Moynihan**. I saw a booklet that you prepared with some startling numbers indicating that there are 203,000 some lakes in the Province of Ontario.

Mr. **Brydges**. I think the tally for Ontario is something like 250,000 counted and probably 250,000 uncounted. I think that the tally for Quebec in similar geological conditions is over a million.

Senator **Moynihan**. Over one million lakes in Quebec?

Mr. **Brydges**. We haven't counted them.

Mr. **Perley**. There are half a million counted; I can tell you that.

Mr. **Brydges**. We say over a million. We don't say how much over a million, but that is the tally.

One of our most recreational areas, Muskoka-Haliburton, includes in it the fact that it has the heaviest acid loading in the Province of Ontario. We have a sensitive area. We have use of the area, and we have the acid loading.

What I will do is give you a brief technical tour here this morning. In some ways, if I was a lawyer, I would be pleading a case on behalf of the fish.

The second picture shows some of the control equipment that we set up on the lakes that we are studying. The purpose of this is to tally up the "substance budgets." We measure the water that comes and goes to the lakes. We measure all the material that comes down from the atmosphere, and what we are trying to come up with is information on the present state of the water quality, the changes in the water quality with time so we can project into the future; and to get information on what happens to the materials that are deposited.

All of the acid that comes down doesn't just simply run off as acid. Much of it is neutralized and so on. We are learning about that using this calibrated water approach. This second picture is an example of one of the control structures that we set up. We run about 30 or 35 of these now.

The third picture that I have shown you is another one of the same kinds of things. There it is. It was deliberately photographed in the wintertime to emphasize the fact that during the winter, the acid deposition still comes down with the snow, but, of course, it accumulates. When that snow melts, and you see a condition there where the snow is just beginning to melt and the snow has increased and the acid which has accumulated in that snowpack is not neutralized, or at least to a large degree is not neutralized. Some of that acid gets through the watershed and into the streams and into the lakes.

Senator **Moynihan**. Doctor, are we to take the yellowish quality of the water as indicating acidity?

Mr. **Brydges**. No.

Senator **Moynihan**. No?

Mr. **Brydges**. No. It may, in fact, be in that particular case. You may be alluding to the fact that groundwater lakes tend to be more acidic. They are naturally more acidic materials. You have to use this calibrated approach to factor out those effects.

We all accept that there are acidic effects naturally and so on. You can do that by doing this flow substance budget. That is part of what we are doing.

Senator **Moynihan**. Nice.

Mr. **Brydges**. The next picture, then, shows some of the results that we started to get from this kind of structure. The top graph that you see is simply a measure of the flow of water during the springtime in March, April, and May.

Obviously, of course, as the snowmelt comes on, the flow of water increases, and it remains high for almost all of the month of April. There were heavy rains during that time as well. So there is rain coming down on Snow Mountain. The important thing here is the bottom curve.

Senator **Moynihan**. The acidity goes down. The acidity goes up as the flow increases; yes.

Mr. **Brydges**. Yes. We had a tenfold increase in this particular stream in the acid content of that water where we have a very health pH of 6.5 in the spring and by April 20, it was down to below 5.5. By May and June and July, it creeps back up again. The importance of this graph is that we now believe this is the most—the single most common response of the aquatic systems to the acid loading.

This phenomenon of spring pH depression, as we call it, or spring shock, acid shock, is common in many of the thousands of lakes that we have talked about. If you measure the lake quality in July and August, you will find the lake looks rather well. The pH looks all right; things don't look to be too much of a problem.

But during that spring runoff, the water quality is deteriorated to the point where in some cases, you can end up with fishkills and clearly, if a fish dies in April, it isn't much good to him to know that things are going to be better next July.

One important point that has to come out of this is that much is said and much concern is raised about the historical effects. We don't know whether acid rain is getting worse or better or so on. We don't feel that that issue, while it is important and it is necessary to work on it, we don't feel it is critical to the action.

Senator **Moynihan**. If I could interject.

Mr. **Brydges**. Sure; go ahead.

Senator **Moynihan**. Wouldn't there be a time series on this? The pH scale has been around for a century, hasn't it?

Mr. **Brydges**. A little less, maybe.

Senator **Moynihan**. Wouldn't there be a time series on it?

Mr. **Brydges**. Do you mean eventually the pH goes down and stays down?

Senator **Moynihan**. No. Wouldn't we have a reading on the pH of rain from 1910, 1911, 1912?

Mr. **Brydges**. No, we don't. That is one of the great problems that is bedeviling us now.

Senator **Moynihan**. No one did that?

Mr. **Brydges**. We don't have good historical data.

Senator **Moynihan**. They measured how much it rained but they did not measure the pH.

Mr. **Brydges**. Not pH, nor was anyone out with wires.

Senator **Moynihan**. What is it you are not measuring in the eighties that centuries from now they will say, "My God."

Mr. **Brydges**. We have some thoughts about that. That will be the subject of another hearing. I won't go into that.

Senator **Moynihan**. All right.

Mr. **Brydges**. Our point is underlining the Minister's comment that Canada feels that the current 1981 conditions are unacceptable. It is not relevant or not completely relevant to be concerned about whether things have been getting bad, worse or different. We are concerned with the current conditions that we believe that the current effects as we see here are justification for a controlled program to be put in place right now.

In all the data that we have, it indicates that in the future, the conditions that you are seeing there will only get worse.

Let me just complete with a couple of comments. As I said before, we have one of our study lakes where we have actually observed fishkills. A university group is on contract to us. They have actually observed fishkills. They confirmed this last spring by putting fish in near one of the inlets where the acid was coming in. The fish were killed in 2 days.

In a controlled lake, they survived for 4 days, which is the period of the test. We have documented that. The next picture we show you is a series of little graphs. I will draw your attention to the shape of the lines. If you look on the left-hand side, you will see the hazardous class distribution of the fish population of a lake near Sudbury during a period when the lake was being acidified. It was going from a healthy pH to an acidic situation. The age class distribution of the fish was changed. You can see on the bottom only young fish in this particular case were remaining. They don't reach sexual maturity. The population is gone.

Then if you look on the right-hand side, you will see two control lakes where we have high alkalinity that are not experiencing the pH depression to the degree that many of the lakes are, and a lake at the top which is, in fact, experiencing these effects. I think you can see where it is obvious that the fish population in that top lake is beginning to look the same way as the population did on the left-hand side when the lake was acidified.

We take this as further strong evidence that the fish populations are beginning to collapse under the acid stress that they are getting right now.

This is the important point.

Senator **Moynihan**. Do you want to help us with Crosson Lake there, Doctor? That profile is very much that of George Lake in 1972.

Mr. **Brydges**. That is right.

Senator **Moynihan**. I thought you said to us that this was a control lake because of the high alkalinity.

The condition of the bottom two lakes, Red Lake and Apparent Lake, arises from geological conditions.

Mr. **Brydges**. That is right. When the glaciers came over this area, they were very messy, and they mixed up the material. We find that two lakes very close together, one may have a higher alkalinity, and the next one may have none.

Senator **Moynihan**. Largely the result of the rock formation?

Mr. **Brydges**. That is right. Little bits of limestone were left there by the glacier. Heart Lake and Red Lake are two examples. They still get the acid loading, but they are not responding. They are resisting to it.

Crosson Lake has a lower alkalinity. That just——

Senator **Moynihan**. You say the fish population is just collapsing where there is no natural resistance in the form of limestone deposits?

Mr. **Brydges**. That is right. We believe by comparison that that is an example of that as a result of acidification.

Now a point to make here is that clearly, we can't do a lot of studies on lakes like that. There is so much effort involved, so we are never going to be able to come to you and say, "We have documented that kind of effect in thousands and thousands of lakes."

We can't afford to do that. What we must do is take that information from the few key study lakes and extrapolate it. The last table that I submitted, if I have it, is simply a measure of the distribution of the alkalinity values which we believe is a good measure of the lake's resistance or its susceptibility. I have circled a few there, and you will see in the Muskoka-Haliburton area that the percentage of lakes with the extreme sensitivity, those are lakes where the alkalinity would suggest that the fish damage that we documented in those slides is occurring there as well, anywhere from 24 to 30 percent or higher of the lakes in those areas are in that category.

If we go to the next category, which may have a little less damage, but still some biological effects, we jump to as high as a cumulative 90 percent of the lakes.

It is an example of the buffering capacity of the lake or the ability to neutralize acid. We have arbitrarily broken that out. One of my final points on that is very important in dealing with the control of this problem.

Clearly, the lakes have a distribution of data, and if—the greater the acid loading, the greater the number of lakes that will be affected, and the greater will be the effects in the lakes that are affected.

There is often a feeling among industries that if we can't solve the problem, why do anything? That is part of the frustration, I think, in the action program now. Our point is that every increase that you get is simply driving more nails into the coffins of the lakes and the rivers and the wildlife in those lakes and rivers.

Conversely, every reduction that you get is going to help a few more of the lakes. In other words, it is not necessary to, in our view, to be sure that you are going to get all of the acid out of the atmosphere before you take action.

We are saying every bit helps, and coming down, and every bit going up hurts. It is a sliding scale.

Mr. SCHEUER. Mr. Chairman?

Mr. BRYDGES. With that, I will conclude.

Mr. SCHEUER. We get the complaint from our industry that the Canadians are so linear, are in a different direction from the reduction in sulphur dioxide on the one hand and acid rain on the other hand. No one has ever proven that that is a linear relationship.

The results of achieving a 50 percent-reduction in sulphur dioxide emissions are absolutely enormous, and to say that there will be a reduction of 50 percent in acid rain is unjustified by apparently available scientific evidence. They think the whole thing is so fuzzy that they look to say, "Well, it may be poison; all this stuff may poison a few fish in Canada, but we can't see any cost-benefit-ratio justification."

Mr. BRYDGES. I think Gregg can answer the details of the relationships but beyond the fact that maybe the one-to-one hasn't been proven, but one-to-one hasn't been proven that it won't happen, as well. In other words, if you cut back, people say, "It may not cut back correspondingly." Theoretically, it may be better than that. I think if you put garbage into the atmosphere, you get garbage back. In terms of the economics, that is another very large issue.

I simply say, we are looking at an incredibly vast, complex and unique ecosystem. We have no right as environmentalists to pass that ecosystem on to our children in a completely destroyed state.

We just have no right to do that.

Senator MOYNIHAN. At a certain point, will the acidic level of a lake become fixed and stay there such that it cannot recycle itself back to a normal pH level?

Mr. BRYDGES. I think not. I think our evidence—we have very limited evidence—but we do have some that if you take a lake—for instance, if you continue to load these lakes, as we know from the Sudbury case, that eventually the pH won't come back in the spring.

Senator MOYNIHAN. It won't; you can kill the lake.

Mr. BRYDGES. That is right. If you can stop the loadings, how long will it take to come back? I think we have some tentative data to suggest that that can take place in two decades; perhaps not a geological timeframe, but if you are living off a tourist industry or a fish industry, it doesn't do you any good. Perhaps with a unique population of wildlife, you can't wait for 20 years for it to get better. The population is gone.

Senator MOYNIHAN. I would like to say to my colleague, Chairman Scheuer, that it seems to me we are getting very close to scientifically acceptable controlled data that proves your case. I mean——

Mr. BRYDGES. I think so. I think we are there.

Senator MOYNIHAN. You have fish profiles from acidic lakes and alkaline lakes. Clearly, the fish population is collapsing in lakes that do not have a natural buffering capacity.

We can see the acidic level rise as the spring runoff brings more snow with deposits into the water. We can show the effects on the fish population. At that point, you know you have a problem. You have identified the source.

You can explain the problem. It is not a mystery that at a certain level of acidity, water will not sustain fish life.

Mr. BRYDGES. That is right. There has been clearly a simplistic view, and Carl Schofield mentioned that when that pH was down, the aluminum concentrations go up. There is many other things happening at the same time. There is even further supporting evidence in those lakes that there is distortion to the algae populations and mercury concentrations in fish are increasing, as are the emissions to the atmosphere and this may be another aspect of the trends to pollution.

Senator MOYNIHAN. Doctor, did you have a comment?

Mr. VAN VOLKENBURGH. If I could just add, as the atmospheric scientist in our delegation, a comment to Dr. Brydges' comments about the linearity and nonlinearity; it is a bit of a shell game. I don't think you are really going to find too many scientists in the atmospheric field who are going to say if you—that it is going to be really backwards.

We are arguing about whether it is perfectly linear or whether it is maybe not quite linear. I think the feeling is that we have got enough evidence. We know there is a huge preponderance of emissions of sulfur dioxide in this part of North America. It is huge.

There is a reference that we have submitted that says it is 10 times the natural emissions of sulfur. We know that is going to be doing something. If you cut it, it is going to help. Maybe it won't be perfectly linear, but it surely is going to help.

Maybe an analogy along this line could be drawn: The space program, when they go and launch the manned space capsules to the Moon or they launch them into orbit, they don't have a perfect trajectory. That doesn't stop them from launching. They launch them and then they make a midcourse correction.

That is the kind of philosophy we feel you can operate on now. You don't have to have every single little piece of information perfectly understood before you begin.

Senator MOYNIHAN. Mr. Minister?

Minister NORTON. If I might make one very brief political comment on that, I think, Senator, that the linear or nonlinear argument is a perfect ploy for those having a vested interest in not doing anything about the problem.

If they can confuse the issue in the minds of the public, that may, in fact, diffuse the concern. I pray we do not allow that kind of argument to confuse what is scientifically and logically an obvious conclusion in the evidence which does exist.

Mr. SCHEUER. That is precisely the reason that I raised the point, because this is exactly the kind of rhetoric we are going to be hearing in the next 6 months when we take up the Clean Air Act, that the Canadians are all emotional about a few fish being killed, and that there is no scientific cause-and-effect relationship between reduction of sulfur dioxide and reduction of acid rain; and it is all a big tempest in a teapot.

We are going to hear that, and we are going to hear that from very powerful political forces both in industry and in the administration. This is going to be David Stockman's rhetoric. We have invested him with an enormous amount of power in this recent dumping of legislative authority from the legislative branch to the executive branch in which I take great shame in what we have done in our own process this week. Forearmed and forwarned, we might as well know the rhetoric we are going to be hearing. We might as well get our scientific act together to prove as best we can, to prove that the reasonable level of expenditures are going to achieve significant and major improvements in our environment, whether it is exactly linear or not; but that *x* hundreds of billions of dollars of investment in reducing sulfur dioxide and the other noxious pollutants are going to produce, with reasonable certainty, why, improvements in the quality of our lakes, our forests, our croplands and so forth; and we better fine tune it as best we can.

Minister NORTON. May I answer that?

Senator MOYNIHAN. Mr. Minister?

Minister NORTON. I think we must be careful because I do believe that we run the risk in our discussion of what is now a very high profile issue: that of acid precipitation or acid rain; that we not overlook the other and very related problems of transboundary air pollution and long-range transportation.

We have information, for example, on crop damage in Ontario resulting from ozone and similar contaminants, and heavy metals, organics, things of that nature. Acid rain is a major concern, but I would not want to leave the impression that that was the only area of concern in the area of long-range transportation of contaminants. It clearly is not a concern to—even the acid rain concern goes much beyond simply talking about fish. I mean, I recall a hearing where Mr. Stockman was quoted on one occasion as saying: "Order a few fish and prepared us with a $100 million investment in abatement." That is not what we are talking about.

We are also talking about something of very major economic impact. Our problems alone in industry are in excess of $1 billion a year.

Mr. SCHEUER. Where does that come from? Is that your crops? Is that your forest industry?

Minister NORTON. Speaking only of our water-related tourism and recreation.

Mr. SCHEUER. Very much like the loss in the whole Adirondacks area.

Minister NORTON. We have underway something which is not complete, but we have a special team of economists who are working on trying to quantify, as much as possible, the whole matter of economic impact, and I am very anxious to share the results of that research with you.

Mr. SCHEUER. I would ask unanimous consent, Mr. Chairman, if you could get that to us in the next week or so, that we hold the record open.

Senator MOYNIHAN. We certainly will. I must say it is marvelous what this issue has done for the interests in the finer points of scientific methodology.

Are you sure it is not curvilinear?

Mr. MCLEAN. For even politicians.

Senator MOYNIHAN. I think that we can move on, Dr. McLean. We have been hearing a good deal about Ontario. Perhaps we can hear from you about Quebec.

Mr. MCLEAN. Thank you very much for the invitation, Mr. Senator.

Senator MOYNIHAN. Your Parisian accent is a little difficult.

STATEMENT OF RONALD McLEAN

Mr. MCLEAN. I think as many people have mentioned before, the measure of the seriousness of this problem to Canadians is the fact that you have got so many Canadians here on this, Canada Day. I am rather lucky in coming from Quebec in that we had a national holiday last week so I managed to get that one in.

The task of amending the Clean Air Act would be onerous enough if it were only to address making improvements to achieve the aims of the 1970 and 1977 versions. The nature of this acid rain problem is such that Congress must take a global view of air quality instead of the present position of setting air quality standards on a local or regional basis. It is hoped that in addition to the aim of, as I read last week in Environmental Science and Technology in an editorial: "How best to achieve and preserve clean air in our country," that Congress will make due consideration of the impacts of its amendments on other countries, particularly ours.

This brief that I am presenting today covers two subjects that have not really been dealt with extensively and for which we do not have firm evidence that there is damage. We know that there is damage, but we do not have the scientific proof yet. That is the impacts of acid deposition on sensitive areas of Quebec in general; and on agriculture and forests of eastern North America.

I will assume that we all accept the following facts on acid rain: The quantities of acid deposition from the atmosphere to much of the Eastern United States and Canada are several times higher than those in "background" regions. These regions also experience deposition which is higher than that observed in the much smaller area of southern Scandinavia where it has been known for several years that acid rain has caused the elimination of fish populations and other biological changes in hundreds of lakes and rivers.

Acid deposition in eastern North America has given rise to well-documented increases in acidity and decreases in a buffering capacity in river and lake waters over a wide area including Pennsylvania, New Jersey, New York, New Hampshire, Ontario, and Nova Scotia. These regions, they are all documented in. This acid deposition has adversely affected fish populations in the lakes and rivers of these areas. All the other possible causes of acidification of these waterways have been discounted.

The major cause of the acidity of precipitation which is acidifying waterways is the emission of sulfur oxides. Perhaps the atmospheric scientists don't know yet the relation between sulfur oxide emissions and the amount of acid precipitation released. I believe that it is known in Scandinavia. People dealing with the effects have come up with models of the effects of reduced acid deposition of the environment.

As to the acid rain situation in Quebec, Quebec has at least measured a half a million lakes covering an area of almost 200,000 square kilometers. On the basis of the major bedrock structure of Quebec, we can see that 90 percent of the area of the Province is covered by the Canadian shield, which is a precambrian granitic bedrock and has very little buffering capacity against acid precipitation. The area of Quebec which receives, on an annual basis, precipitation as or more acidic than that which is considered to cause damage to the most sensitive lakes in southern Scandinavia is more than 600,000 square kilometers, or more than twice the impacted area in southern Scandinavia and somewhat larger than the area of New York, New England, Pennsylvania, and New Jersey combined.

Considering these facts, perhaps it is somewhat surprising that we have heard very little about the subject of acid precipitation in Quebec. Basically, it is because no one up until now has been going out to look and see whether there is a problem. It is not because the problem does not exist.

In spite of the lack of attention until now, work has been accelerating rapidly in recent months, and a number of surveys have been carried out revealing the extreme sensitivity of Quebec's waters to acidification.

It has been discovered that in some of the most famous fishing areas in the St. Maurice Valley and Laurentide Park area that lakes have been acidifying recently and that fish populations have been diminishing. The cause-and-effect relationship has not been established, but it is very clear that it is going to be established as it has been in other areas.

In Quebec, sport fishing is very popular, the major industry. Most of it takes place in these waters which are threatened by acidification. As with other States and Provinces in the Northeast, Quebec would like to see this threat removed. At present, the population is not sufficiently sensitized to the issue, but it is becoming so, and when they see that its sport fishing is threatened, their pressure for action is going to be as much as it has been from Ontario and the Adirondacks.

Quebec, at the moment, is a net recipient of acid deposition. It does have one of the largest single point sources; a smelter in Noranda, which emits 600,000 tons of sulfur dioxide per year. However, despite this enormous amount, in all the studies that have been carried out so far, it has been impossible to show a significant contribution to the acid deposition in Quebec outside an area of 20 kilometers from the source.

This is compared to the acid rain which is coming from the south.

Mr. SCHEUER. What is happening to all that sulfur dioxide?

Mr. MCLEAN. It is certainly going into the atmosphere and causing a contribution, but it is impossible to measure that contribution more than 20 kilometers from the source with present techniques.

Mr. SCHEUER. Do you know where it is going?

Mr. MCLEAN. It is probably going a very long way. A lot of it is coming down here. A lot of it is going out into the Atlantic and possibly even some of it is affecting Europe.

The other area I would like to deal with is the effects on the terrestrial ecosystem. Up until now, we have heard that there will be effects. There is contradictory evidence, and at present, the scientific community is not satisfied with the evidence that it has seen that there is a strong relationship between acid rain in remote areas and effects on the forests.

We know the damage is there. As I said before, we know it is there, but we don't have good, scientific proof. However, I believe that in the very near future that this scientific proof will be there, and we have a tremendous amount of recent work from New England which indicates that there are effects in the forests.

Senator MOYNIHAN. Has there not been work done in Sweden, Norway? You would look to that?

Mr. MCLEAN. The work in Sweden, it has been shown in the early seventies that there was a decrease in the growth of trees over the last 30 years.

In Norway, the work that has been done there in the forests and in the forests they have been looking at there, they have not shown a decrease in growth. However, one cannot discuss the forests just in terms of being the forests. There are many forests where great differences in nutrient requirements, resistance to disease, et cetera; will all react differently to small contributions, although they may react the same way to large depositions. If they have a small amount of acid deposition, they have different effects. If they have a large amount, it will kill them.

Although in Quebec there is little data on tree growth, there is much evidence of degeneration and tree damage. That is causing great concern to our industry. It is impossible, therefore, at present to link it to acid precipitation, however, as I mentioned, more recently in the North and Eastern United States there has been a similar amount of evidence which is linked to acid precipitation.

Stress has been observed widely with observations of decreasing growth rates, yellowing of foliage, crown dieback, increasing mortality over wide areas, but especially in areas known to have deposition of acid on stream and lake chemistry.

I am going to mention the work of three forestry scientists in the United States whose work as yet has not been published. I would very strongly recommend—I think that this is the evidence that we have been waiting for on the effects on forests. I think these people should be contacted: Dr. A. H. Johnson from the University of Pennsylvania has reported; "* * * an abnormal decrease in growth rates over the past 25 years" in all species and all ages of trees both in plantations and native in the pine barrens of New Jersey; Dr. D. J. Raynal from the State University of New York in Syracuse found Adirondack forests have significantly decreased growth rates in the last 30 years.

The red spruce in the Green Mountains of Vermont have been found by T. G. Siccama of Yale University and H. W. Vogelmann of the University of Vermont, Burlington, to have decreased between 1964 and 1979. Vast and increasing numbers of dead and dying red spruce and trees with damaged foliage can be observed throughout New England.

The above authors have eliminated all the other major known factors which could have caused these effects; for example, drought, fire, pests, et cetera. In all cases, they suggest the long range transport vehicle, particularly acids, into these remote areas as the cause.

More specifically, Johnson has eliminated the possibility that atmospheric oxidants have caused them. I am sure the decreasing growth is directly related to the stream water quality. A causal relationship with acid precipitation is quite definitely suggested.

If one looks at the situation——

Senator MOYNIHAN. That plant biology, they can account for this in the same manner that they can account for the fish deaths?

Mr. McLEAN. Yes; they have taken into account all other factors that they believe may be impinging on this forest.

Senator MOYNIHAN. Is this what is left? Is there a chemical sequence that has to lock them in?

Mr. McLEAN. The chemical sequences are at higher levels. Acid precipitation has been very well established. It is well established that there is damage to root tiers. There have been several years of work done in Germany now. One of my colleagues, George Tomlinson, whose report on the German situation I have presented to you, has produced for us the work of tourist groups in Germany where they are showing considerable damage to their forests.

It is interesting to note that if one picks up the papers in Toronto over the last year or so, you get an observation of every fish that has died due to acid precipitation. At present, you pick up the German newspaper and you find the same thing with trees that they are now extremely concerned about the state of their forests, and they have quite clearly indicated that this—the damage is being caused by air pollution.

In some cases, acid precipitation is the serious problem. In other cases, it is the oxidants.

Mr. **Scheuer**. Has the damage, according to them, been due to acid precipitation in Germany? Is Germany the source of the problem?

Mr. **McLean**. They are a considerable source of the problem, but most of the problem is from the eastern part of Germany.

Mr. **Scheuer**. From whence does that pollution come?

Mr. **McLean**. They think it is coming from Czechoslovakia, Poland, East Germany, Hungary.

Senator **Moynihan**. Can I just say, Doctor, that yesterday we held hearings in Burlington and Prof. Richard Klein, who is from the University of Vermont, spoke of his work with Dr. Vogelmann. Can I just press you for one second? You say a causal relationship with acid precipitation has been suggested. I see. I see. I'm sorry. I didn't see that. Has it been established? You are at that level in research where you can find correlations?

You find symptomatic phenomenon. You say there must be an explanation. The probability that this is the source of the phenomenon is high and the exact nature has yet to be determined?

Mr. **McLean**. If you have established in laboratory experiments or controlled experiments that these effects are observed, and you then observe them in the field under similar conditions and you eliminate all other causes, then that, to a scientist, is satisfactory evidence that a cause-and-effect relationship exists.

One final point I would like to bring up is what do we control to protect sensitive ecosystems? I think clearly, we have to have controls in the emissions of all acid gases, but there has been a great deal of discussion of if we can control SO_2 emissions relatively easily.

The energy and coal industry have said it is a great deal more difficult to control NO_x emissions; that for controlling SO_2 is not going to be as much of a problem because we can't deal with NO_x emissions satisfactorily at present.

I disagree very strongly with that position from a scientific basis. In eastern North America, most of our vegetation is nitrogen deficient and requires atmospheric inputs of nitrogen, but little of the vegetation is sulfur deficient. The nitrate from nitric acid is readily consumed. In the consumption of nitrate, acid is used up and therefore nitric acid in precipitation is not available to cause further acidification damage. Therefore, unlike sulfuric acid in acid rain, nitric acid is not such a significant contributor to the long term acidification of the environment in remote areas.

Though there is little doubt that tighter controls are necessary to diminish the effects of acid rain, the existing control strategies which have put more emphasis on the control of emissions of sulfur oxides than nitrogen oxides have a reasonable scientific basis given our present limited knowledge of the effects on the ecosystem.

By all means, control of nitrogen oxides are necessary to protect our human health, et cetera. But let us not dilute our efforts to solve the acid rain problem by attacking more than the true source of the problem: sulfur oxide emissions.

I will end my statement.

Senator **Moynihan**. Doctor, thank you very much. That is first-rate testimony, as it all has been, and I think now, Mr. Perley, that it goes to you.

STATEMENT OF MICHAEL PERLEY

Mr. **Perley**. Senator, thank you, first of all, very much for the opportunity, Chairman Scheuer, to testify today. On behalf of the Canadian Coalition on Acid Rain, before I get into the standard parts of my testimony, I just wanted to mention that the coalition is a group of 25 businesses, tourism, recreation, and conservation groups from all across Canada with memberships totaling over 1,250,000 Canadians. I would want to underline the fact that we have what has been called a group of fairly strange bedfellows on the coalition in terms of groups that traditionally have banded together regarding so-called environmental issues.

I think we have heard a great deal of material this morning as to why this cannot be considered any longer as a traditional environmental issue. We have people, very, very hardheaded northern Canadian tourist operations in the Canadian nation, tourists, associations of tourism, sportsmen from Canada, and a variety of other groups of diverse makeup.

I was asked to speak to you briefly about why Canadians are concerned about acid rain. I think that question has become redundant.

From the presentations we have heard this morning, we have known that the Canadian scientists are among the foremost in the world, and those in Ontario have really developed a pretty substantial case, virtually complete, as far as the aquatic effects are concerned and very, very suggestive, in terms of work that is going on in terms of others, Dr. McLean's, work.

Perhaps I can just elaborate on a few points regarding the psychological aspect of why the Canadians are concerned and a couple of words about tourism and the forestry industry and pass on to some activities that we have been pursuing and things going on in the administration recently.

I think simply put, the northern wilderness forms part of the Canadian psychology: the fact that we have lakes and rivers and mountains which we have been escaping to or fighting for for over three centuries shows that we have a very intimate, and close, and longstanding relationship with the wilderness and hundreds of thousands of us vacation, fish, and cottage every year. I think it is important to underline the fact that this sort of activity is not restricted to a privileged few. It is certainly not restricted to central Canada.

I can think of everyone from the salmon fishermen in Nova Scotia, to the tourist outfitters in northern Saskatchewan, to the British Columbia coastal salmon fishermen, to the hikers, and campers, and fishermen in northern Alberta. All these people have a longstanding heritage of close contact with the wilderness and all the areas that I just mentioned are under some threat, however minor, from increasing acidity of precipitation in either wet or dry form.

I just might then turn to a few words about tourism and recreation. As the Minister mentioned, we will have some substantial figures on the direct impact of acid precipitation on tourism from Ontario shortly.

I might note that it is our second largest industry and provides $5 billion in annual revenue to the Province. That is not just the sports fishing. That is the entire gamut of tourism activity. It forms a major part of the economies of all eastern Provinces.

Just as an example concerning sport fishing—unfortunately, I don't have any more recent figures than 1975—we had over 600,000 fishing licenses registered to Americans living in Ontario. I have pooled residents and economists tell me there were over 1 million American fishermen in total because all fishing did not require a license in Ontario in 1975.

As concerns some of the other regions of Canada, there has been a documented loss of salmon populations in Nova Scotia by Federal Government scientists. Saskatchewan tourist outfitters are very concerned about the impact of acid precipitation from the Alberta tar sands and extraction gas plants blowing across the border. Here we have another transfer problem that is affecting their borders of the Canadian shield.

British Columbians are concerned about a proposed coal-fired development going in there which might affect their salmon fishing.

In short, the Canadian population is, in general, very sensitized to the issue.

As regards the forest industry, I can only add to the strength of Dr. McLean's comments, I think, by noting that the forest industry, as a whole, contributed $11.5 billion to our balance of payments last year, 1980. This can only increase, we hope. At the same time, the Canadian Paper and Pulp Association has noted there may be problems with a decrease in the fiber content in the next few years.

This is not due to acid precipitation necessarily. It is due to logging practices. Should there be a slight, even annual decrease attributable to acid precipitation on top of that projected loss, our economy is in very, very serious difficulty.

I would like to resume regarding the concern that we are expressing here and that many Canadians feel. I think, sir, that you certainly are well aware of the impacts on your own state of acid precipitation. Therefore, it is not surprising and it won't be surprising to learn that many of the present reports emanating from Washington are concerning many of us, in particular, the draft proposals released by the press for Congressman Waxman 2 weeks ago seemed to indicate serious contemplation by the administration of a major relaxation of the Clean Air Act.

I think that particular fact, or those particular proposals that were released are of particular concern to Ontarians given the very substantial mitigation measures that have been legislated by the Government. Normally, it is unequaled in hydro. The Federal Government has given new guidelines for air pollution standards which are almost similar to those given by the EPA.

This was sent out in April. As well, though, there are another series of activities and facts which concern many of us; notably, the draft amendments proposed to the Congress by Representative James Broyhill of North Carolina have caused many members in the coalition concern and also the reports of the apparent sympathy of the Interior Secretary Watt toward further relaxation of environmental concerns during this.

Sir, your committee has a very onerous responsibility in the reauthorization of the Clean Air Act. It is not our place to suggest how this should be done or to demand certain reforms.

But what we are concerned with, I guess, as a focal point is if the act should be seriously weakened or changed in any way, the United States would find itself in direct contravention of the memorandum of intent signed on August 5 last between our Governments. The memorandum states in part that—if I could just quote briefly from it—that the Governments, prior to developing a bilateral air quality agreement will, and I quote: "* * * take interim actions available under current authority to combat transboundary air pollution."

We feel the memorandum is an expression of the desire to collaborate closely on this problem. We would hate to see such a direct contravention occur.

The Minister noted a number of the arguments of certain vested interests concerning the fact that acid rain is not a problem; it doesn't exist; it is a matter of a few hysterical Canadian scientists, et cetera, which is very confusing to the public.

I have been advised that recent surveys of opinion in the United States indicate that there is a broad constituency which supports, at a minimum, maintenance of the Clean Air Act in its present form, and which would apparently approve stricter control.

I am thinking particularly of the Harris survey indicating that 86 percent of those interviewed opposed making the provisions of the Clean Air Act less strict. I am also referring to the Arthur D. Little survey reported inside EPA, dated June 19, 1981. That issue was inside which described an underlying distrust of the goals of business as they pertain to reauthorization of the act. This survey found that two-thirds of the respondents feel that either environmental progress and economic growth are compatible or they favored environmental protection over economic growth.

This latter result was supported by a recent Newsweek poll done by the Gallup organization reported on June 29. That magazine indicated that 75 percent of the respondents felt that it is possible to maintain strong economic growth in the United States and still maintain high environmental standards.

The Canadian polls of the past 2 years contain similar results and there appears to be a strong transboundary constituency in support of continuing and effective environmental controls; notably, regarding air quality.

In summary, Senator, I guess my comment is that many Canadians are worried that acid rain and the transboundary pollution will become a serious irritant to Canadian-American relations. We come to you with all the good will at our disposal to request that you and the other distinguished members of your committee give serious consideration to the longstanding and excellent relations between our two countries in your deliberations on the act.

These relations can only be strengthened and reaffirmed by your efforts to maintain reasonable and sufficient standards of air quality and environmental quality for both our countries. Finally we certainly, all of us, look forward very much to what we hope will be the visit of you and many of the members of your committee to Ontario and perhaps other parts of Canada, I believe in August, to have a look at the situation firsthand.

We would hope to have a chance to have some of our member groups and representatives there to meet with you and discuss the situation further.

Senator MOYNIHAN. Surely that couldn't be more generous. I couldn't agree more. Let me just say two things: One, that that Memorandum of Understanding constitutes an agreement between our Governments. Congress must be sensitive to it.

Mr. Chairman?

Mr. SCHEUER. Mr. Chairman, this has been remarkably interesting testimony. It is part of a continuous flow and continuous discourse. My committee is having hearings in Lake Placid 2 weeks from Friday on the 17th. Ean Watson is coming down with a group of parliamentarians to talk substantially about this subject and the need for your country to achieve a legislative consensus that this problem is worth meeting.

We have heard a lot of talk about cost benefits. We are going to hear a lot more talk about cost benefits, but I would just like to throw in a word for the bottom line that ultimately, there are other factors than costs and benefits. I don't know how you quantify the cost benefit terms, the fact that the Potomac River and the Hudson River are within a year or two, now, of being swimmable. We spent $7 billion on our tertiary sewer program. The results have been, well, they have just made me feel prouder to be an American, if you can put a cost benefit factor on that.

Jamaica Bay, which I represent, which is one of the great urban waterways of the world, was one of the world's great cesspools and sinkholes not many years ago.

Just a few days ago, an elderly Irishman who must have been in his eighties came up to me, his eyes glistening. I wish I could replicate something like your accent, Mr. McLean—Irish or Scot. He said, "Congressman, do you know that for the first time since I went clamming with me granddaddy in the years long ago, I am now catching clams in Jamaica Bay and shrimps and scallops, too. Congressman, I just want to tell you, it's wonderful."

How do you crank that into a cost-benefit calculus? I don't know how, but on the bottom line, there has to be some pride of country, both on our side of the border as well. It is obvious from the anger that you exhibit up there that there is a great deal of it on your side of the border. I think Americans simply are feeling good about the fact that we already have made immense progress in cleaning up our rivers and lakes. We have done it in the Great Lakes. We have done it in the Potomac and the Hudson. We have had marvels with the Jamaica Bay. I think at best it is a pride of hanging on—I think you mentioned this—a hanging on to a planet and a country that is richer in its glories of nature for our kids and grandchildren than what we inherited. That is a sort of a courage, too.

This is the courage of men who go out and fight battles, and this is the courage of old men who plant little seedlings that will grow into trees, but trees under which they will never sit. Maybe none of us will live long enough to recognize and be around when the full benefits of this fight are felt. I congratulate you on your high quality of professionalism and your high quality of courage.

I hope that on our side of the border, we will be able to match it. You set us a wonderful example, and I am very grateful.

Senator MOYNIHAN. Well said, sir. Mr. Minister, do you want to close up? This has been extraordinarily helpful to us.

Minister NORTON. Thank you very much, Senator Moynihan and Congressman Scheuer. I would just, in conclusion, again like to thank you very much for the warm reception that you accorded us today. On a day that is very important to us as Canadians, it is also very important to be formally received by our neighbors in the United States.

I know that our Secretary of State for External Affairs, when he attended the conference in Buffalo, extended an invitation to you and your colleagues, I believe, to come to Canada. I would like to both reaffirm that invitation and extend it on behalf of Ontario, if you can do that, to those of you on your committee and to any of your other colleagues who share an interest or a concern, to come up and perhaps firsthand have a look at what we are doing; look at what is happening and we would be quite happy to devote whatever staff time is necessary in order to provide you with a full briefing on the research that we have on this undertaking.

It is very difficult to do that in the time constraints of a committee hearing, but I extend to you a very sincere and warm invitation to come back.

Senator MOYNIHAN. You couldn't be more generous, sir. For my part, I accept, and I shall see that the chairman knows of the invitation as will the members of the committee.

Thank you very much indeed, gentlemen. That is the end to the technical part of this hearing. We will now resume hearing from witnesses in the normal manner.

We have a panel of some of the more distinguished researchers in the field; Dr. Carl Schofield of Cornell University; Dr. Anne LaBastille of Lake George, N.Y.; Dr. Paul Lioy of New York University; Dr. Peter Coffey of New York Power Pool; and Dr. Michael Oppenheimer of the Environmental Defense Fund.

Would these gentlemen and lady come forward now if you are all here? We are running a little late. I wonder if it would be possible to ask each of you on the panel to summarize what you wanted to state in about 5 or 6 minutes so that we can take questions at the end, if we can?

Of course, your full statements will be included in the record. I want to break here at just about 1 o'clock. We will be free to resume and everybody is going to be heard at whatever length they desire.

Now, Dr. Lioy?

This will be a very solid hearing record when we are through.

STATEMENTS OF PAUL LIOY, INSTITUTE OF ENVIRONMENTAL MEDICINE, NEW YORK UNIVERSITY; CARL SCHOFIELD, CORNELL UNIVERSITY, ITHACA, N.Y.; ANNE LABASTILLE, LAKE GEORGE, N.Y.; PETER COFFEY, NEW YORK POWER POOL, SCHENECTADY, N.Y.; AND MICHAEL OPPENHEIMER, ENVIRONMENTAL DEFENSE FUND, NEW YORK, N.Y.

Dr. LIOY. Good morning, Senator Moynihan and Congressman Scheuer. I would like to discuss with you in my testimony this morning the broader issue of transboundary pollution and then maybe work my way back to acid rain.

I think it is appropriate in these times of the reauthorization of the Clean Air Act to try to go to the more general issue and see how we have to try to attain a balance of how we approach pollution problems.

The characteristics of atmospheric pollution——

Senator MOYNIHAN. May I just say that your statement will be placed in the record. This will be the case of everyone if you can proceed to summarize it.

Dr. LIOY. OK. There are four major categories of processes; meteorological processes associated with the development and the accumulation of atmospheric contaminants. They can be described as local, what we might call community air pollution problems where we have processes associated with problems like in New York City with carbon monoxide or gaseous, vaporous hydrocarbons from some sort of chemical setting within an urban area. That is one process.

The second process we call a mesoscale transport. In this case, we are not only looking at the material emitted locally, but directly out of the stack. It comes from no other transformation processes, and it can be usually distinctly characterized as a tracer source. In the mesoscale process, we deal with the problem of transformation. The transformation is the most complex category, the transformation of hydrocarbons, nitrogen oxides, sulfur oxides, and the like. In this particular instance, we are dealing with pollution that has been traveling in distinct plumes approximately 100 to 200 miles downwind. This has been evidenced by major research programs conducted by both the Environmental Protection Agency, the academic community and other research-oriented forms of electric power institutes.

They have shown distinct plumes downwind.

Beyond that, we reach the area of synoptic—meteorology of synoptic scale transport, which is the area of main focus of acid rain issues which is the fact that we have not only individual plumes which can be associated with particular types of weather systems, but we can have plumes that can amalgamate, can enhance one another. They pile up. They can distribute over wide areas.

We have two types of weather systems. One is called the fair weather meteorology, which is the high pressure system which you are normally familiar with based on the weather maps you see on television or from literature.

In addition to that, we also have a low-pressure system which is the wet weather process, the scavaging process, the scavaging of atmospheric progress. The chemistry and physics associated with these two systems are very, very distinct.

The main feature which is consistent is the actors aren't the same. The actors are nitrogen oxides, sulfur oxides, hydrocarbons, and various secondary products.

We are dealing with a system which likes to perpetuate itself. We think of free, radical chemistry, which is not linear chemistry; it is nonlinear chemistry. It can occur both in the droplet phase and in the gaseous phase.

However, it produces such items as ozone, sulfuric acid, nitric acid vapor, and reacted hydrocarbon species.

Senator MOYNIHAN. Nonlinear chemistry?

Dr. LIOY. Yes; meaning heterogeneous processes.

Senator MOYNIHAN. This is as before.

Mr. LIOY. Cloud chemistry, where you can have the measures of the various materials directly within the cloud and in droplet phase forming the various substances; for instance, the ozone-sulfur dioxide reaction in the droplet which produces sulfuric acid.

So we are dealing with a very interesting system, but the thing is that the actors are the seam in the wet weather system. It is the processes which are different. The accumulation patterns in the high-pressure system is that you will assume high concentrations of sulfate, demonstrated in many, many studies.

The acidity of that sulfate aerosol would be dependent upon how much ammonia is available for neutralization. This is from supporting documents.

We found that there is a deficiency in rural areas of ammonia, except over, I would say, agricultural regions, where you can have an agricultural-related nitrogen emission, but there has been demonstrated greater acidic aerosol in rural areas rather than in cities.

In terms of acid rain, you are dealing with the chemistry within clouds, the formation process of sulfuric acid and nitric acid and then the washout of those materials within the cloud droplets, rain droplets. Beyond synoptic meteorology, there is what we call long-range transport.

There have been a number of studies done showing the transfer of arctic haze from regions over eastern Europe to areas like Alaska which decreases the amount of visibility associates with that region. That is long-range transfer. Actually, the fact that these materials can be carried 20 days has been the demonstrated time.

Within the Clean Air Act, I feel that we are dealing with a nonboundary issue. I haven't mentioned a boundary here or there within any discussion at this point. I think that is the summary. There are no boundaries. The atmosphere has no wall. The only walls are the natural boundaries of the water or surfaces over which it passes, high mountains, et cetera.

Political and social boundaries will not reduce the problem. If you try to legislate a local problem or a regional problem, you will never get a resolution of the issue. The issue has to be terminated or it has to be completely addressed from a transboundary perspective. This transboundary perspective can go from community to community to country to country.

Senator MOYNIHAN. And continent to continent?

Dr. LIOY. And continent to continent. Therefore, the enabling legislation within the Clean Air Act must address transboundary issues so there is a local transfer of information and discussion on what is the appropriate way to resolve international and frightfully local issues which can get out of hand.

Senator MOYNIHAN. So I take it you are saying that the physics of this phenomenon have been in some measure, done. It has been conceptualized. It has been quantified. We know it is there. We know what we are talking about; we know the forums.

Dr. LIOY. We know the different forums, the different regions in which it can transport. The problem is the chemistry.

Senator MOYNIHAN. The chemistry is still difficult?

Dr. LIOY. And the actual dose or receptor.

Senator MOYNIHAN. But we know these things which are not visible to the naked eye are known to exist. They exist as much as the Hudson River exists.

Dr. LIOY. We cannot predict as well as we like.

Senator MOYNIHAN. We can in some form, I guess.

Dr. LIOY. The prediction does fall down and we get from the mesoscale, which is the plume, because the plume is the point source for an urban area. We get the many, many sources together. The intervening distances in between, we have not been able to quantify exactly.

There are five or six models which give you varying degrees of accuracy.

Senator MOYNIHAN. But you know what you are trying to do?

Dr. LIOY. Yes.

Senator MOYNIHAN. That is always the great entry point. All right, sir.

Dr. Coffey?

STATEMENT OF PETER COFFEY

Dr. COFFEY. Thank you, Senator Moynihan. Thank you Congressman Scheuer.

My name is Peter E. Coffey. Presently I am administrator of air programs for the New York Power Pool. In my previous position at the New York State Department of Environmental Conservation, I served as chief of the long-range transport section. I also served as coordinator of the New York State Inter Agency Task Force on Acid Precipitation.

I have been involved in acid precipitation since 1973. I have written a number of papers on the subject.

Let me just try to summarize my testimony by starting out. Acid precipitation was developed by Cogbill and Likens papers in 1974 and presented especially three main points: the precipitation of the Northeastern United States is acid; over the last quarter century this acidity has increased greatly; and three, that it is capable of doing ecological damage.

Since these initial assertions were made, a number of projects related to acid precipitation have been undertaken and completed. Indeed, the precipitation in the Northeastern United States is acidic.

Sulfuric acid and nitric acid are by far the major acidifying components.

Senator MOYNIHAN. Sir, you say here that the yearly average of pH is 4.2?

Dr. COFFEY. Approximately 4.2, Senator.

Senator MOYNIHAN. Extraordinary.

Dr. COFFEY. I will get into the relationship of 4.2 toward what has been presented as a natural pH of 5.6. I am getting a little bit ahead of myself. If you want, I will drop back.

What we found as far as the yearly cycle of precipitation, in the summer we get mostly sulfuric. That is the dominant acidifying agent. In the winter, we get mostly nitric, and this has, as the Canadians brought out a little bit earlier about fish kill in the spring, the spring brought out some interesting complications if you are just talking about controlling of sulfuric acid.

Let me go on now to the second point, the increase in acidity. In 1975, Thomas Harr and myself wrote a paper in which we analyzed the precipitation results from 9 years of data from a network of USGS sites in New York and Pennsylvania. We looked at eight sites in New York; we looked at one site in Pennsylvania.

What we found, if you look on these figures, figures 1 through 4, we found that we couldn't see any trends. We found there was a great variability from year to year; precipitation didn't seem to have any seasonal variation. It just seemed to be a random variation from year to year.

However, if you will look at table 1 on this paper, you will notice that the pressure source of these pollutants in what we call the SURE study area, the Eastern United States and Canada, from Ontario, eastward. This is the area of interest for us in the Northeast.

Senator MOYNIHAN. The SURE study?

Dr. COFFEY. SURE study was a study on sulfate emissions. In fact, it is still not finished; a sulfate regional experiment.

Senator MOYNIHAN. Thank you.

Dr. COFFEY. I cannot remember these acronyms either.

If you take a look at the figures of the total emissions, you will see there isn't a very big spread from season to season. In NO_x and SO_2, however, the precipitation pH has quite a big spread.

Tom and I decided that the only explanation is climatic variation. I will give you an example of what you would expect. If you have a pH solution of, say, 4, and you had an increase in low buffet as range, suppose you added 25-percent acidity to a pH 4.

I pick 4 because I can do that. It comes out that the precipitation pH would drop by one-tenth of a pH to 3.9. You can take a look at these figures. We are seeing changes in several pH's.

The only explanation has got to be climatic variation.

Several other researchers have since looked at the Likens and Cogbill data. Likens and Cogbill took data from 1955–56 and they contrasted that with data from 1965–66. They showed a dramatic decrease in precipitation pH.

The people looking at the 1955–56 data have come to the conclusion that the acidifying components didn't change very much. However, the alkaline material, which can also affect pH, alkalinity from the atmospheric processes will also affect pH. The alkaline materials were much higher.

The reason for this is that in the middle 1950's, the mid-United States experienced one of the greatest droughts ever. These were the very great drought years, and a lot of windblown dust containing calcium and magnesium was present in the air at higher levels than was present after the drought was over. This raised the pH.

Senator MOYNIHAN. So the decline may be a phenomenon of atmosphere?

Dr. COFFEY. Rather than emissions.

Senator MOYNIHAN. It could be a random phenomenon?

Dr. COFFEY. It is a random—if you say climatic variations—a random.

You mentioned 4.2 as a very low pH. I think it is, however, we are contrasting that with a pH of 5.6; 5.6, if you know much about acid rain, 5.6 is the equilibrium pH. Atmospheric carbon dioxide dissolved in rain bottles will give you a 5.6 pH. There is not a droplet formed in the Earth's atmosphere that does not form around a potter.

There is no a priori reason why these particles should be neutral, as they would have to be if you have 5.6 pH. Nature can produce on her own, without man's help, strong acids, strong bases.

The formative processes of precipitation are such that I believe the pH is dominated by strong acids and strong alkaline agents.

Data that is coming in from remote sites around the world indicate that the pH of rain and snow is very variable from the mid falls. Mid to high fall is up to the mid-5's. Average E-5 in the Northern Hemisphere were somewhere around 5.0.

Data from ice cores in Greenland, one fellow has gone back, drilled a core that goes back to 500-something A.D. The pH, after he looked at it, averages in the low fives for the lost millennium. There hasn't been a big change in the pH in recent years.

Basically, I want to say that the 5.6 is erroneous. It is some other number. I think it is going to depend upon where you are and what the climatological conditions are.

Senator MOYNIHAN. You think it is lower?

Dr. COFFEY. Lower; however, there may be some places in the Midwest where it may be up in the 60's, 70's.

Senator MOYNIHAN. 4.2 is a very different number?

Dr. COFFEY. 4.2 is a very different number. I believe it is quite a bit lower. I believe most of the sulfur in this region is anthropogenically produced.

Senator MOYNIHAN. Would you explain?

Dr. COFFEY. Man made. I would like to conclude by talking just a little bit about the ecologic damage. The only area that we can scientifically demonstrate that there is ecologic damage are aquatic regions.

This brings us to our Adirondack mountains. I believe the science that has been done up there, the effects that something is happening in the Adirondacks, however, at this stage of the game, I do not believe that we know enough about what is really happening up there.

I believe we should—we need more research. The State should have more research going on in the Adirondack area. Also we shouldn't be quite so myopic when we look at the problems in the Adirondacks as to realize there can be other sources of the ills in the Adirondacks.

These lakes are not in a pre-Columbian state. Man has impacted these lakes for quite a while now. The State of New York has had a fish stocking program that has been going on for about 100 years.

We should look at this and what changes in policies that this might have produced; what the effects or changes in policies in this fish stocking program might have produced on the lakes.

We should also look at what effects forest fires would have. In the first quarter of the 20th century, there were a lot of fires in the Adirondacks. Possibly, they might have had effects. Fires will free alkalinity that can flow into the water systems.

We should also look at other things that have gone on in the Adirondacks. For example, in the late forties and through the fifties, there was a very large program to eradicate the black fly but putting DDT bricks in all the streams in the Adirondacks. Maybe this had some effects also.

But anyway, to develop a complete picture of what is going on in the Adirondacks, we should look at all these things and discount them. Then, and only then will we be able to say, "This is due to acid rain and these are the mechanisms that we will employ to get rid of the problem." Thank you.

Senator Moynihan. A perfectly fair statement and very straightforward. I am still surprised at that 4.2. It is a surprising number.

Dr. Coffey. They can get along.

Senator Moynihan. They can get along?

Now to a very distinguished resident of the Adirondacks for rebuttal, confirmation or extension, or what you wish, Dr. LaBastille.

STATEMENT OF ANNE LaBASTILLE

Dr. LaBastille. Yes; I just drove down from the very center of the Adirondacks. My remarks will be today on the general impacts that were seen there or are suspected to be happening from acidic deposition.

I would just like to note that these impacts are cumulative and have been going on for perhaps two to three decades and are affecting many ecosystems. Largely, the effects have been gradual in sizability and acid useness, but they are definitely becoming quite noticeable.

I am wearing three hats when I come here today. One is representing CANARI, which is this button that you are wearing. In case you don't know what CANARI stands for, it is another acronym: the Coalition of Adirondackers to Neutralize Acid Rain Inflow. We couldn't get something with a "y," so we got an "i."

Of course, the symbolism is that we feel that the fish dying in the lakes is like the canary in the mine as a kind of warning about the larger environmental threat that we are facing.

Senator Moynihan. Very nice.

Dr. LaBastille. The other hat I am wearing is as a concerned citizen and resident of the Adirondacks for 25 years. I have been living on a lake; I have my own property there, and I have seen it go from a prime crop fishing body of water to one with no fishing at all. I will say a little bit more about that later.

The third hat is that I am the Commissioner of the Adirondack Park Agency, which is the State land use planning agency which has control over the 6-million acre State park.

Just to say a little bit to describe our Adirondacks in more detail, we are, as I mentioned, a 6-million acre park in which you could easily fit five national parks if you wanted to try to squeeze them in.

We have 1.1 million acres of wilderness and very beautiful scenery over 3,000 lakes and 30,000 miles of rivers and streams. There is practically no industry and practically no agriculture. We are heavily visited by tourists. Approximately 9 million people a year come to the mountains, summer and winter.

It is interesting to note that the park was formed in 1892 by the State of New York and part of it is to be kept forever wild, so we have an obligation to the people living there to—all of the people in New York State—keep it this way.

The four major areas of impact that we notice in the Adirondacks, I won't dwell too much on them because I know we have already heard from some people.

Carl Schofield will address the aquatic ecosystems, but they are, No. 1, the aquatic ecosystem. We have heard about the problems with fish. I just want to add to that that fish-eating wildlife such as otters, mink, heron, and certain ducks, are also obviously affected by any decrease in fish life.

Also, in general, as our lakes are becoming less and less productive, they are also less useful to mankind and less fun to be on because recreation is severely curtailed. We made a study in 1975 at the Park Agency that there is approximately a $1.5 million loss in sport fishery per year because of the acid problem.

A second area would be in air quality and visibility. Again, we hear about this quite often, but I just would like to say that early reports by surveyors in the literature indicated that we had magnificent clear sparkling days many, many—a large percent of the year.

This has definitely decreased in recent decades. In fact, two of our atmospheric scientists who are quite reputable in the State, Ray Falconer and Vincent Schaeffer, have noticed in the past 15 years that summer visibility has definitely decreased.

I would say that we don't have much of a cultural heritage in the Adirondacks. We don't have beautiful churches and museums, but we do have a natural heritage. One of the strong parts of that heritage is in our clean air, the mountain vistas. This is being gradually deteriorated. Of course that would affect the tourism that we depend on as one of our major industries.

Forest ecosystems is the other area we suspect there are problems in. We have heard very beautiful testimony from Ron McLean today on some of the suspected damage of tree growth and root damage, and so on. I won't go into that.

The last area I feel is very significant because of the potential health hazard; that is in the acidification of groundwater. We are finding in the western Adirondacks, right in the area where I, unfortunately, happen to live, there is a definite problem with wells and springs and small municipal reservoirs.

About three summers ago, the New York State Department of Health came up and sampled several homes and wells and springs to get levels of heavy metals as well as the pH. They found almost without exception that in about a 30-mile radius where we took these samples there were very high levels of copper, aluminum, and lead, and the residents had been complaining of their plumbing leaching through very rapidly, much more rapidly than would normally occur; and of the drinking water having strange tastes and these high levels of toxic metals.

Apparently, this is going to be a problem that will worsen as time goes on. In general, these four areas, I feel, it is just in the last three decades that we have seen these changes. I am sure that if you could go back, say, to the ice age 12,000 years ago and look at the nature and the checks and balances which occurred, there was no such phenomena that appeared like this before.

Obviously, nature had its own way of balancing natural acid. Today it has been totally overreacting because of the manmade deposition that we are seeing up there.

If I could just step out of my central role and stop being an ecologist and ask you to step into the role of a homeowner, I have a pH meter, and I went out two afternoons ago and went to the three lakes that are on my property. I had bought this place 15 years ago.

I had the idea it would be a wildlife refuge, my home, my writing studio, and a haven. I went around to all my lakes and I put in the pH meter. I got readings of 4.3 to 4.5 in the three lakes. The spring where I get my water, untouched by human hands, was 4.4.

When I was at these lakes looking around, there was no wildlife, no herds, no fish rising, just aquatic insects, a few floating on the surface. I really could have cried all the way home because that is not what I bought the property to be.

I have seen this property in 15 years—it is my emotional feeling coming out. I don't know how you could get a cost-benefit analysis on that. I don't know what can be done except to really try to strengthen the Clean Air Act amendments and stop this from happening.

I am wondering what is going to be there in the year 2000 when I go up to those lakes and do the same thing.

Senator **Moynihan**. I think you have every right as a home owner as well as an ecologist to complain. There is no doubt about that.

Dr. Schofield, you are the one American scientist who has done the most to describe why there are no fish up there, or have you? You can tell us, sir.

STATEMENT OF CARL SCHOFIELD

Dr. **Schofield**. Yes, I have been partly responsible for some of the work in the Adirondacks. The written statements and the supporting papers I have referenced in the statement and I will be submitting to this committee, I think, document very clearly the observed impacts of acid precipitation or more precisely, I think, the effects of excess atmospheric sulfate deposition on sensitive aquatic ecosystems like the lakes and streams that we are dealing with in the Adirondack Mountains.

Inventories that were initiated by the New York State Department of Environmental Conservation in 1975 and have been continued since then indicate that currently something more than 200 lakes in the Adirondacks are what we consider to be in a chronically acidified state.

These are waters that have essentially completely lost any carbonated buffering capacity, maintained pH levels below 5 at all times, and exhibit unusually high concentrations of toxic metals, particularly metals like aluminum, which are leached from surrounding soils and watersheds.

Also, fish are generally absent from these waters. Attempts that have been made to reestablish or maintain drought fisheries that have been historically established by stocking have not been successful simply because of the adverse waterfall conditions. It is quite clear the fish will not survive in these waters in the present condition.

Senator MOYNIHAN. Why is it quite clear that they will not? Is it because they don't or because you know why they don't, speaking as a scientist?

Dr. SCHOFIELD. It is quite clear that it is the low pH conditions and the levels of toxic metals that inhibit survival of fish in these waters.

Senator MOYNIHAN. Precise biological sequences that you can identify?

Dr. SCHOFIELD. That is right.

Senator MOYNIHAN. Would you tell us what they are?

Dr. SCHOFIELD. Physiologically, the effects of most of the acid and metals are at the level of the fish's gill. They inhibit the fish's respiration and prohibit the necessary transfer of nutrients to the fishes.

Senator MOYNIHAN. What happens to the gills?

Dr. SCHOFIELD. The actual fish you damage to the respiratory region on the surface and insufficient ion change which causes nervous disorders in fish, so generally the physiological fish. Generally, the younger fish are more sensitive.

Loss of younger fish can result in extinction of fish.

Senator MOYNIHAN.The clinical analysis of what happens to the fish is pretty well established?

Dr. SCHOFIELD. That is right; that is right.

There have been additional studies in the Adirondacks and other impacted areas that are in a similar condition that have qualitatively defined these relationships between atmospheric deposition levels of sulfate, acidification of lakes and streams and these biotic responses. They are not just fish, but there are other categories as well.

I think it is very clear that it is the atmospherically deposited sulfate that is the driving force leading to the acidification and mobilization of toxic metals in these aquatic systems. That is clear from this literature. I think, further, that the very expensive field of laboratory studies being conducted in this region have demonstrated the pH and metal levels currently observed in clinically acidified lakes and those that are subjected to episodes of increasing acidity.

We heard this morning from our Canadian friends. In these situations, the metals and acids are acutely toxic to these fish in these streams and lakes. Unfortunately, we don't yet have very satisfactory quantitative expressions of these linkages, the linkages between sulfur emissions; for example, sulfate deposition, lake acidification and ecological responses.

Senator **Moynihan**. You see a change of events, but——

Dr. **Schofield**. That is right.

Senator **Moynihan** [continuing]. But can you quantify it one way or the other?

Dr. **Schofield**. We have models that express these linkages, but we don't have the necessary transfer functions or quantification functions at the present time. I think because of this it is difficult to predict the cost once it has decreased or increased the emission scenarios within the final computations that would satisfy a scientist.

At the same time, I think only approximate levels of sulfate deposition that should not be exceeded, for example, if sensitive aquatic resources could be recommended. Since these are approximations that are based on empirically derived observations, primarily from regional studies, there are uncertainties associated with predictions that should be considered. I don't think that necessarily should inhibit the utilization of this best available information at the present time.

For example, we want to protect our most sensitive aquatic resources. These models and information suggests sulfate deposition levels should probably not exceed something on the order of 15 to 20 kilograms per hectare per year, which, in this area, would translate to approximate weight, annual pH levels of precipitation of something on the order of 4.6 to 4.7.

That is on a sustained basis. It also assumes that the acidity is due primarily to sulfuric acid. You should note that the current levels of sulfate deposition is sensitive in still pristine areas like regions in the North and Central United States and Eastern United States. The sulfate level depositions there are just below this current threshold.

Senator **Moynihan**. Just below this current threshold. Where are we?

Dr. **Schofield**. Here in the Northeast, we are something on the order of two to three times above that threshold level.

Senator **Moynihan**. About 45 to 60 kilograms per hectare per year?

Dr. **Schofield**. That is right.

Senator **Moynihan** We are three times above the threshold level.

Dr. **Schofield**. Yes. This raises a question. Could reductions in sulfate deposition of that order of magnitude be achieved in the United States? If they could, could we expect to see clearly acidified lakes respond in terms of being returned to relatively pristine conditions?

I think we have to expect that there have been some irreversible impacts occurring. One of these probably is the loss of uniquely adopted stocks of fish. This in a sense constitutes an irreversible loss in the diversity of gene pools available in most species of fish.

Certainly, it might be possible to reestablish some species of fish and maintain active sport fisheries, assuming that water quality conditions could be restored to suitable levels.

The extent of irreversible losses in the water buffering zone, for example, or nutrient losses in soils I think is an uncertainty at this point in time.

On the other hand, if sufficient reductions could not be achieved, realistically, in this region, what are the alternatives we have? They should be elected. We simply, at this point, sacrifice sensitive aquatic resources or should potentially available options for amelioration of effects be employed in the systems?

I think these are some of the kinds of policy-based questions that I hope your committee will be addressing in the course of your deliberations, possible emission control scenarios in the Clean Air Act.

Senator MOYNIHAN. Thank you very much, sir. That is a frightening proposition; that 15 to 20 kilograms per hectare per year is about the threshold to keep things as they have been. We are three times that.

Dr. Oppenheimer, can you tell us what to do?

STATEMENT OF MICHAEL OPPENHEIMER

Dr. OPPENHEIMER. I hope so.

Mr. Chairman, I am the senior scientist in the New York office of the Environmental Defense Fund. I recently joined the Environmental Defense Fund after 10 years as the atmospheric physicist at the Harvard-Smithsonian Center for Astrophysics at Harvard, where we have been working for some 5 or 6 years.

The Environmental Defense Fund is a member of the National Clean Air Coalition, which is a coalition of environmental citizens and labor groups that got together to defend clean air in this country.

I am also a representative—and I am representing the coalition today—I am also representing a group called the OSHA/Clean Air Network, which is a national organization of environmental and labor organizations.

I am the cochairman of that network of the New York City area.

I had intended to go into the effects area, but it has been covered so well that I am going to limit my discussion to health effects which have not received that much discussion.

Senator MOYNIHAN. The whole paper will be placed in the record.

Dr. OPPENHEIMER. Let me summarize my view as a scientist of the scientific evidence with regard to acid rain.

First, there is no question that precipitation is, at a conservative estimate, is 20 times more acidic than normal in the Northeast.

Second, there is no question that atmospheric loading of sulfur and nitrogen compounds primarily from anthropogenic sources and in the Northeast, ever woefully primarily from powerplants as the source of the sulfur nitrogen compounds which are causing the acidity problem.

Third, the detailed mechanism for the transformations into sulfates are not well understood, but some such mechanisms have been identified. There is no question that the transformations occur.

The SO_2 and NO_x emissions are transformed into acidic material.

Among those acidic materials are the suspended fine particle sulfates and nitrates, which are known to be significantly more hazardous to health than other air pollutants that are already controlled. Fine particle sulfates and nitrates are not, at this time, controlled criteria pollutants. There is no way to deal with them in the present Clean Air Act in any direct way.

Fourth, there is, in addition, no question that long range transport plays a significant and, for many areas, a dominant role in the distribution of these pollutants.

If you look at the models which have recently come out, many of them sponsored under the United States-Canada Research Consultation Group, there is no doubt, for instance, in my mind, after a fair look at these models that much of the material reaching the Adirondacks originates outside New York; outside the mid-Atlantic region, primarily in the Ohio River basin and the upper Midwest.

The other evidence for long range transport was discussed by Dr. Lioy previously. I don't consider the arguments about what the historical trends of what the last 20 years have meant at all. The loadings have increased also over the last 20 years.

Fifth, one wouldn't expect the acidity of precipitation to have necessarily changed that much. Arguments about meteorology are also irrelevant. We can't help the effects of weather. Without the sulfur and nitrogen loadings, there would be no acid rain; at least there would be a much lower acidity of rainfall, let me put it that way.

That is something we can do something about. For this part of the world, for North America, there is no question whatsoever that the background pH should be substantially higher. Whether it is 5.3 or 5.6, I don't want to argue with that. But there is no question about the anthropogenic loadings of sulfates and nitrates are the problem.

What is going on in Samoa is not relevant to this problem, not relevant to North America. I think all the arguments about the details of the process of meteorology, all of this can serve as a certain level of obvious indication of the problem. The problem has been identified. It hasn't been identified but it has been identified well enough.

We have transportation of acidics into transformation. The transformation of ecosystems has been documented sufficiently well this morning.

Let me contain my remarks to the health effects. As I said, the fine particles are suspected of having significant health effects. You must understand that the fine particles are concomitant to the acid rain problem.

You could not have acid rain if you did not also have fine particles. The two go together hand in hand. They are particles which are known to have significant health effects. They are more dangerous to health, it is believed, than SO_2, for instance.

Mr. **Scheuer**. You are talking about dry deposition now?

Dr. **Oppenheimer**. Particles before dry deposit. Before dry deposit, you breathe them in. They are not controlled. They are part of the acid rain problem. They receive little attention; they are a health hazard.

EPA was asked to set a standard, all to naught. We believe an unqualified part of the acid rain problem and something that gets little attention is the fact that if we eliminate or reduced significantly sulfur loading in the atmosphere, we would get rid of a significant fraction of this health problem which is a human health problem which warrants edification.

I want to search further. But after careful consideration of what the long range transport models show today, I am willing to say that it is my best estimate that a given reduction in SO_2 loading will result in an approximately equivalent reduction in atmospheric sulfates. That is, if you cut SO_2 loading in half, I would not be at all surprised to see a concomitant reduction of atmospheric sulfates of a factor of two.

I wouldn't swear by the number, but it seems to me to be the best number you could give, given the understanding of the models and the ability of the models to predict the results of atmospheric sulfate measurements such as the SURE experiment mentioned before.

Mr. **Scheuer**. Do you have any scientific basis for what you have just told us? That is very important, that last paragraph.

Dr. **Oppenheimer**. That statement comes from what I consider a fair-minded evaluation, as an atmospheric physicist of the models that have been used, mostly models which are analyzed under the transboundary memorandum discussed earlier.

If you look at them carefully, they can be matched fairly well to atmospheric measurements to sulfates. To my mind, that match rules out the possibility, say, that a factor of two reduction in SO_2 will leave us with a 5 percent reduction in atmospheric sulfates. I just don't believe it.

I think the best guess is a factor two reduction would give something comparable to a factor two reduction. I don't swear to the number 2—close enough.

Mr. **Scheuer**. There is a pretty linear relationship as a rule of thumb.

Dr. **Oppenheimer**. I wouldn't use the word linear, because the word linear again gets into the argument of whether it is exactly a factor of two. Let me say I think the relationship would be more linear than the relationship that would give you a 5 percent reduction.

I know I am sticking my neck out on that a little bit, but to my mind, that is a fair approximation. So let me say that if we were able to retain those reductions that both suspended final particles, which are a health hazard and which contribute to dry deposition, and which, in some areas, are the major cause of acidification, that those suspended fine particles would result in a reduction. That is something you can count on.

What can we do about this problem? I will skip testimony and go to the proposal of the National Clean Air Coalition to deal with acid rain. We have a 14-step proposal which there is not time to go into in detail. Let me summarize the main points.

First, it is my judgment that the time is long past to do something about this problem, and that further studies can be undertaken now, but it is also the time for action and that this problem cries out for action and immediate action.

First, the Congress should specify an initial total emission reductions goal and a year for attainment of that goal. Intermediate goals and years could also be specified. This, by the way, is a national recommendation, no wild-eyed environmentalist recommendation.

Congress should identify the major sources to be involved in the initial mitigation program. The initial program should deal with Eastern Utility SO_2, which is a major culprit in the Northeast.

Second, the allocation of emission reduction responsibility in order to achieve the initial goal should place the heaviest burden on the dirtiest sources according to a congressionally mandated formula. That is where the difficult politics will come in. I am not prepared at this time to tell you exactly what that formula should be.

Third, all sources involved should submit a compliance schedule to be given to EPA by a fixed date. This procedure properly assures the design of a mitigation strategy for a problem at the Federal level which no one State can solve. However, States may opt to be involved in the enforcement of compliance programs.

I would like to point out that the regulation of hazardous air pollutants under section 112 and new source performance standards under 111 operate currently in this fashion.

My final main point is to permit the most cost-effective program, compliance may be pursued by trading regulations among the various sources throughout the East. Compliance may be achieved through any combination of enforcement emission reduction strategies, such as retrofitting of scrubbers, coal washing, resubmissions to stashing and others.

Let me say in this context that our Governor this morning spoke about coal cleaning at the mine mouth. I just want to comment as an appendix to the National Commission on air quality report. It was established that the national coal cleaning program can only reduce sulfur loading by 10 percent, so that while we regard some coal can be cleaned up to 30, to 40 percent, but on the average, of all coal used in the East, a lot of coal can't be cleaned past 10 percent. That is not enough.

That is one fragment; a piece of a bigger picture. It is not the major piece. More has to be done. Other techniques and technologies need to be used.

Finally, there are a bunch of other suggestions that we have which are in our testimony. Since oil backout was mentioned, we believe that oil backout should be accomplished with no net increase in sulfur emissions because, although we believe oil backout in the East is important, since it can be accomplished with no net increase through retrofit of scrubbers in some case, low sulfur coal in others, to resubmission dispatching, we don't see any excuse for making the acid rain problem upwind from New York and New England any worse by a conversion to coal in the dirtiest possible manner.

If you would like to ask me about any other element of the program, I would be pleased to provide my answers.

Senator MOYNIHAN. Thank you, Dr. Oppenheimer, and thank you all.

There seems to be some divergent views here. I was wondering which of you disagrees with anything some others have said, I think Dr. Coffey does.

Dr. COFFEY. I have a few areas of disagreement. The last speaker, Dr. Oppenheimer, mentioned that most of the acidity comes from the fine particles. I have done a bit of work on this study. The general feeling now is that there are heterogeneous reactions—heterogeneous meaning two phased reactions, gas to liquid—that go on during a rainstorm, which we don't know what the heck is going on during this time.

But this produces most of the acidity. There is no measurement that I have ever made on fine particles that would correlate with the acidity of the rain. I do agree with him that he has gone out on a limb when he says chemistry was linear. He said it was linear but it wasn't.

Dr. OPPENHEIMER. Quasi.

Senator MOYNIHAN. Curvilinear.

Dr. OPPENHEIMER. Quasi, a scientific way of saying yes and no.

Dr. COFFEY. I have been involved in this problem for the last 9 years. I wouldn't want to make that statement. We honestly don't know what would happen.

One other statement I would like to make in relation to something the Canadians stated and something Carl stated—and maybe Carl can straighten this out—the Canadians, I believe, this morning, mentioned that perhaps the worst aspect of the acidity was the shock and the spring melt.

Dr. Schofield was talking about the worst part of the acidity is due to the sulfuric acid. The snow melt, as I understand it, is mostly nitric acid. If you take a look at the emissions during the winter, you will find, to put this in perspective, in the SURE region, something like 50 percent of the emissions come from the utilities.

This is in the United States and Canada. Something like 40 percent of the total acidity in the winter is sulfuric; 60 percent is nitric.

If you put numbers on this, 50 percent or 40 percent, I just worked it out. You get about a tenth of a pH unit of change if you have no sulfuric acid coming from any powerplant in the SURE region during the wintertime. Your pH maybe goes from 4.2 to 4.3; very small change. I would like Paul to explain this.

Senator MOYNIHAN. This is a pretty serious subject.

Dr. COFFEY. I think what I am saying is I have heard two people saying two different things, both experts on fisheries.

Dr. LIOY. I think I can clarify the point. First of all, sulfate comes into the system; is stored somewhat so that there is very little change in sulfate concentrations in stream runoff, for example, seasonally. That is not the case with nitrate, as has already been pointed out, since it is a nutrient in demand.

It is taken up by vegetation during the growing season. During the winter, when there is no demand for nitrate, there is runoff relative to sulfate, but sulfate is still the predominant acid. Even though the nitrate is associated, the increase of nitrate is associated, the increase of nitrate is associated with the increase in acidity, in the natural process, there would be no change in pH if the sulfate levels were not as high as they are.

I would just like to present a couple of questions and also one point on health effects:

First, the question I have in dealing with sulfur dioxide is that we are dealing with a problem or a pollutant that is driven by a number of other materials, mainly free radical or, in some cases, primarily sulfuric acid from a powerplant or a home using space heating.

In the wintertime, we don't have a lot of space heating around the country. There is evidence showing that the initial estimates made for emission factors of primary sulfuric acid from commercial boilers, boilers in apartment houses, was low.

In the wintertime we do get higher primary sulfuric acid. We should remember that in the wintertime most of our sulfur dioxide in a normal urban area comes from your home heating process—just something to remember.

We have two times of the year: summer and winter. In the summertime, we are dealing with photochemistry. We are dealing with reduction of ozone. Oxidized hydrocarbons, nitrous oxide, those sorts of things. The whole thing starts not with the sulfur dioxide part of the problem. It starts with the nitrogen oxide is unlikely to be reduced.

Nitric oxide, which then precipitates in a series of—up to 240 chemical reactions. The primary problem is the nitrogen oxide in terms of photochemistry. It hasn't been directly addressed. It is part of the photochemical oxidant problem, and it is part of the sulfuric acid production problem.

It is also intimately related to nitric acid. When we are dealing with this, we are not only dealing with sulfur dioxide, we are dealing with nitrogen oxides, both of which are combustion products. We have to remember that. If we go after one, we may be making a mistake.

Senator **Moynihan**. The question of what is a linear relationships needs to be clarified. X equals Y is a linear relation.

X equals Y-squared is also a linear relation. X equals a .5 Y is linear.

Dr. **Lioy**. Linear is a 1-to-1 relationship.

Dr. **Oppenheimer**. It means if you have two things and you change one by a certain percentage, you change the other by the same percentage. It doesn't mean the same amount. It means the same percentage. My assertion about SO_2 was.

Dr. **Lioy**. That is not my way of describing it. Dr. Oppenheimer?

Dr. **Oppenheimer**. First of all——

Dr. **Lioy**. I have one more comment on health effects.

Senator **Moynihan**. Finish your comment on health effects then we will go to Dr. Oppenheimer.

Dr. **Lioy**. In terms of health effects, we do have a significant amount of evidence saying that deposition of fine particles and inhalable particles, meaning particles we call a total thoracic particulate mass, can be distributed throughout the lung, in the lung body. Part of that will be sulfuric acid. It depends upon how long, how persistent the sulfuric acid is in the atmosphere. As I indicated, in rural areas, the atmosphere is more acidic than in urban areas.

It is an inverse of the normal thing we consider as air pollution. We consider the total exposure of a rural area. In some cases, it is slightly valid. When we are dealing with acidic particles, we are dealing with something that may not only be confined to a major urban area. We have to make sure that we are, again, not locking ourselves into what I would call a single hobbyhorse, where we rock it back and forth and miss major other points.

Senator **MOYNIHAN**. Good. Good. Dr. Oppenheimer, 3 minutes.

Dr. **OPPENHEIMER**. Let me respond briefly. First of all, my comment about final particles, I never meant to imply that they were responsible for most of the acidity on the broad scale of the whole Northeast. What I did say was that in some places, they are responsible for most of the acidity. This is in the scientific literature, and I can bring up references if anyone wants to see them. In any event, they are responsible for the overall part of the acidity. I couldn't agree more with Dr. Lioy.

We need to control the NO_x emissions if they contribute to the overall.

Senator **MOYNIHAN**. NO_x?

Dr. **OPPENHEIMER**. Right, oxides of nitrogen and then clean air Coalition proposal presents suggestions for controlling those emissions.

Third, as far as the question of pseudo or quasi-linearities, what I am suggesting is not that the microchemistry of the fine particulate processes are a bit necessarily linear, but that the whole overall transformation process and transport process behaves in such a way so as the overall process is more or less linear.

That is—and this is all we really care about. We don't really give a damn about the detailed chemistry. All we care about is if you put this stuff into what comes out of here, and I see that that overall process is reasonably close to linear to allow policy decisions on that basis.

Finally, the importance of local sulfates. People have tried to make a big deal about it for a long time. The best scientific evidence to date is still that the long-range transport component is the biggest part of our problem.

Senator **MOYNIHAN**. Mr. Chairman, would you like to ask questions? I know you are very much involved in this.

Mr. **SCHEUER**. I have just two very brief and simple questions, Mr. Chairman. The first is to Dr. Coffey.

Dr. Coffey, it seems to me that you are extraordinarily complacent about the current situation and you would direct us to go nowhere or do anything. On the bottom paragraph of page 7 of your testimony, you say that because of the unknown character of the variables of chemistry, meteorology and climatology, which we don't understand, it is not possible to describe the transport process.

Right there you have knocked your colleague here, Dr. Oppenheimer, out of the box on transport.

You go on to say that, "The initial assertions in the 1970's that precipitation is becoming more acidic has not been substantiated. Acid precipitation as it now exists probably has been around for at least 60 years." Then you close by saying, "The only area of ecological damage from acid precipitation that has been scientifically demonstrated is in certain susceptible aquatic systems."

That would ignore crop damage. That would ignore forest damage.

"Lakes in New York's Adirondacks Region appear to be susceptible to acidification damage," but the impact on these lakes due to acid precipitation has not been established. "More aquatic research and survey information is needed."

Do you know, as a representative of the industry, that there is anything that we should do now, in the next, let's say, 5 years? I don't think anybody feels we are going to have a very much improved data base in much less than 5 years. Do you think there is anything we ought to do now or do we just wait?

Dr. COFFEY. I think, for instance, where we talk about coal losses, I think what I am saying here is your models of your transport models are still in an embryonic stage.

I disagree with Dr. Oppenheimer. You have a mix which I think as Dr. Lioy mentioned, depends—one process depends upon another process.

Your sulfate, for instance, we begin to see the heterogenuous action is more important. This is a microscale. However, the oxidants which are going to involve themselves in this process, ozone, peroxides, are generated, we believe, by the NO_x situation. You can't change one part of this mix without changing another part. We don't really understand this.

We don't understand how you can change one part of the mix and affect the other part of the mix or not affect the other part of the mix.

Mr. SCHEUER. Doctor, you were here when the Canadians testified?

Dr. COFFEY. I sure was.

Mr. SCHEUER. They seem to have a high degree of certitude that there is a cause and effect relationship between sulfur dioxide and acid rain and between increases in acid rain and the devastation of their forests, their crop lands.

Dr. COFFEY. I heard this. I heard the following from Quebec losing 20 kilometers, losing 600,000 tons of sulfur dioxide a year. Hell, that is more than we put out. That is only 12, 13 miles that he has lost it. There is an awful lot of statements being made when you really get right down to it.

Mr. SCHEUER. Is there any kind of remedial program that you would advocate that the program would undertake other than pure research, let's assume, on a parallel track wheel we are perfecting our knowledge base? Is there anything that you would have us do in the meantime other than sit on our fannies?

Dr. COFFEY. I don't think—I say the new sources going in today are being scrubbed. Senator Moynihan mentioned about 4.2 as a low pH. I will leave something with you that will show people in Brazil in the Amazon are recording pH's of 4.3. I think we are at a point right now where 4 or 5 years into research on the lowest scale, there is a very complex area. We do not know at what level controls that you may put in, at what level they would have the source areas, the receptor areas would not show what Dr. Carl Schofield said, whatever their maximum allowable limit is.

I can't tell you, "You control back to such and such a point and this won't happen." No one can tell you this today. No one can tell you on a model, which may be an order of magnitude accuracy, by just changing the emissions what will happen.

When you really get right down to brass tacks, we are talking about a very complex situation.

Right now, in a—I think the EPA is going to come out with an assessment of the oxidant control policy. I believe after several years of cata catalytic mufflers and what have you, they are going to say, "No substantial change in oxidants." We don't want to get ourselves locked into a control policy where we don't understand what we are controlling. We do need some more research.

Senator Moynihan. That is a fair statement fairly made.

Dr. LaBastille, why don't you have the last word——

Dr. LaBastille. I will fight with Peter after this.

Senator Moynihan [continuing]. As a real property owner?

Dr. LaBastille. I can't let what he said that I believe the Miranda stacks at Quebec are almost 1,000 feet high. Perhaps they are dumping it on Labrador and Nova Scotia, and who knows where. I don't know that. I am just suspecting with a little common horse sense.

The other point in Brazil in the Amazon, they are burning 200,000 hectares of tropical forest and there has to be some kind of fallout from that.

Senator Moynihan. The particulate has some kind of consequence. This was an extraordinarily good panel. We have had first-rate intelligence that has helped us. You have not made it easier for us to legislate, but I think that is good. It is not ignorance that hurts so much as knowing all those things that aren't so.

Thank you very much. We will resume at 2:15.

Congressman Scheuer won't be with us. We will begin with a panel including Mr. Sheinkman, Mr. Clancy, Dr. Yeager, and Mr. Cerosky.

[Whereupon, at 1:15 p.m., the committee recessed, to reconvene at 2:15 p.m., the same day.]

AFTER RECESS

Senator Moynihan. A very pleasant good afternoon to you, ladies and gentlemen. We are running a little late. We went into a long discussion this morning on these issues. However, Maurice Hinchey and Linda Winikow are not able to be with us to start out this afternoon. They are in session; the legislature is in session downtown. So we are really more or less on schedule.

We have the great honor this afternoon, as this morning, to have Congressman Scheuer, who is chairman of the House Subcommittee on Natural Resources, Agricultural Research, and Environment of the Committee on Science and Technology with us.

So we will start right now with the next panel. Mr. Sheinkman, who will be representing the OSHA/Clean Air Network; Mr. Richard Clancy of the Niagara Mohawk Power, who will be representing the New York Power Pool; Dr. Robert Yeager, who will be representing the American Lung Association; Mr. Robert Cerosky who is the manager of environmental protection of General Foods, who will be representing the Business Council of New York.

We welcome you all and I think we will just keep to our witness list, unless you prefer a different sequence. I think we will just begin with you, Ms. Woywod.

Thank you.

STATEMENTS OF PAM WOYWOD ON BEHALF OF JACOB SHEINKMAN, GENERAL SECRETARY-TREASURER, AMALGAMATED CLOTHING & TEXTILE WORKERS UNION, REPRESENTING THE OSHA/CLEAN AIR NETWORK OF NEW YORK; RICHARD CLANCY, SENIOR VICE PRESIDENT, NIAGARA MOHAWK POWER, REPRESENTING THE NEW YORK POWER POOL; DR. ROBERT YEAGER, PULMONARY SPECIALIST, SUMMIT PARK HOSPITAL, POMONA, N.Y., REPRESENTING THE AMERICAN LUNG ASSOCIATION, NEW YORK; AND ROBERT CEROSKY, MANAGER OF ENVIRONMENTAL PROTECTION AND ENERGY CONSERVATION SERVICES, GENERAL FOODS, REPRESENTING THE BUSINESS COUNCIL OF NEW YORK STATE

Ms. WOYWOD. Thank you very much for asking us here. I am sorry that Mr. Sheinkman could not attend, but he was called away this morning on an emergency.

Senator MOYNIHAN. We are happy to have you.

Ms. WOYWOD. Thank you very much.

I am the coordinator for the New York State OSHA State Coordination, which is comprised of about 56 national and international unions of the Industrial Union Department of the AFL-CIO, plus the Clean Air Coalition, which at the national level, is comprised of about 20 major environmental groups.

We have gone into this coalition because we are both concerned with health. We feel that the artificial divisions between pollution in the plant and in the community must be broken down. We have found that we have many, many issues that we agree upon and have decided to lend our strength to each other from this point on.

Dr. Oppenheimer, who testified this morning, is with me also.

Senator MOYNIHAN. He is welcomed back.

Ms. WOYWOD. Mr. Sheinkman is not only the general secretary and treasurer of our union but he also served as the cochair of Governor Carey's Commission on Economic Development in this State.

I make this point to point out that we are really approaching the problem of clean air from a point of economic development, good for labor, good for business. We do not believe that there is a choice between clean air and economic development.

In fact, we think it is just the opposite; that clean air promotes economic development if you are willing to take the time and the brains to plan your schedules for development in a city or in a State area.

Rather than go through the entire testimony which I have given you——

Senator MOYNIHAN. Which will be put in the record.

Ms. WOYWOD. Right—I will just summarize what we feel.

We are also approaching clean air because we are the OSHA/Clean Air Coalition, from a matter of health. We have long known that the miners used to carry canaries into the mine in order to tell them if there were fumes that would kill them. The American worker has become the canary for the community.

Senator **Moynihan**. I am putting my C.A.N.A.R.I. button on.

Ms. **Woywod**. Very good.

Most of the toxics and airborne chemicals that are transported in the general community arise out of plants of one kind or another, except of course for carbon monoxide and the mobile sources. We are primarily concerned that our workers are not only dying from occupational health diseases from these chemicals in the plant, but when they return home they and their family are then consumed by the same problems in their ambient air around their homes in their communities.

Therefore, it is very important to us as a union, as part of the coalition, that the standards be retained. Unless the standards are retained, we feel, and unless the deadlines are retained, the States are not going to move to clean up the air that we must have.

We also know that the pressures for cleaning up the air under the Clean Air Act go very—help quite a bit in aiding us with our OSHA goals.

For example, one of the great problems of New York City for workers is the paint solvent problem for painters. It seems that we have been unable, under OSHA inspections, to help the painters. Just recently, we learned that the Clean Air Act in Los Angeles is probably going to solve the problem for us. Because with Los Angeles' difficulty in meeting their standards, they are not allowed to burn the solvent wastes, and therefore, probably the most dangerous part of the chemical is going to be eliminated.

Their workers are going to be helped by clean air, directly.

We also wish to state that we support everything that has been said by the environmentalists this morning on acid rain. The reason is that we are a part of this State; the entire economic health of this State is endangered by acid rain; the recreation industry.

We are concerned about the food being grown in a State that is being endangered by acid rain. We understand there is a study being done now at the Cornell University experimental station on what is happening to grapes that we eat.

We also bring into question what is happening in the orchards; if the grapes are being injured, we wonder what is happening to apple trees, to peach trees, et cetera.

We are concerned from a standpoint of general health with acid rain. We are concerned about economic health with acid rain. But most vigorously, besides retaining the standards as they are, I really wish to put in a plea for retaining the mechanism for the PSD areas.

I know that we have some clean areas of New York State that would come under PSD areas, but let me say most of New York State's problems are in nonattainment areas. It seems to me and anybody who knows about runaway shops would know that it is much easier for a company to go to a clean area that is not going to have to worry about meeting standards for nonattainment areas if they do not have to go through the mechanisms that is required by the PSD.

I therefore, as a labor person, as a part of this coalition, beg that you keep those PSD areas, because this State will not be able to survive it. It will be the last straw. I mean, there are too many reasons why it is easier and cheaper to go to Arizona. We don't need to give them another reason.

I would also like to say that we are concerned. We have elderly in this State. We have children. We have people with respiratory diseases. Our health bill is growing and growing. We cannot afford the cost of lung diseases.

I just got a report the other day on the cost of lung diseases in the Nation. It comes to $49 billion if you include lost time productivity with it. That is considerably more than it takes to clean up clean air.

It seems to me that this country could save a lot of money if it would eliminate the sources that are causing the problems in clean air.

I know it makes it difficult for some industries over others. I think in that case, perhaps plans should be established to have some national help through a business, perhaps bank on this just as there are banking credits for clean air in non-attainment areas.

But if we don't do this, the cost of this country is going to be greater and greater and greater. I don't think we can afford the medical costs.

Senator MOYNIHAN. Did you say that there is a report that makes this $49 billion estimate?

Ms. WOYWOD. Yes, it is, from Georgetown University.

Senator MOYNIHAN. Could you get it for us? We will put it in this record by reference. We will keep the record open until we get it.

If you could find it and see that we have it by reference because that is a powerful number: $49 billion.

[The information requested follows:]

AMALGAMATED LIFE INSURANCE COMPANY

770 Broadway, New York, N.Y. 10003 Telephone No.: (212) 473-5700

June 25, 1981

Ms. Pam Woywod
ACTWU
15 Union Square West
New York, N. Y., 10003

Dear Ms. Woywod:

As you requested, we have checked into the costs of catastrophic illness as they relate to the Clean Air Act.

The most appropriate information we have obtained comes from a study by the Public Service Laboratory of Georgetown University for the National Institute of Health which projects the 1980 national direct and indirect costs of lung diseases (i.e. hospitalization, treatment, etc.) at 19 billion dollars per year excluding lost productivity costs. When taken into account lost productivity costs raise that figure to 45 billion dollars. (See A.L.A. [illegible])

The American Lung Association is sending some additional material to us. I will forward it to you as soon as it is received.

Please let me know if this is useful for your purposes and if we can be of any further assistance.

Very truly yours,

Claire A. Levitt

Claire A. Levitt
Assistant Director
Research and Development

CAL/rcl
cc: Harvey C. Sigelbaum

BIBLIOGRAPHIC DATA SHEET	1. Report No. NIH 74-7/9-1	2.	3. PB280298

4. Title and Subtitle

Costs of Illness and Disease, Fiscal Year 1975

5. Report Date

Jan 1977

6.

7. Author(s)

Selma J. Mushkin, L. C. Paringer, Aviva Berk

8. Performing Organization Rept. No.

9. Performing Organization Name and Address

Public Services Laboratory
Georgetown University
Washington, D. C.

10. Project/Task/Work Unit No.

11. Contract/Grant No.

NO1-5-2121

12. Sponsoring Organization Name and Address

National Institutes of Health
Division of Program Analysis
Office of the Director
Bethesda, Maryland 20014

13. Type of Report & Period Covered

Final Report

14.

15. Supplementary Notes

16. Abstracts

This report presents a discussion of the economic cost of illness for 1975 by disease category and also describes in detail the methodology used in estimating the costs. Included also are the problems encountered and the biases generated from using this particular approach for estimating costs.

17. Key Words and Document Analysis. 17a. Descriptors

17b. Identifiers/Open-Ended Terms

17c. COSATI Field/Group

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1740 Broadway · New York, N.Y. 10019 · (212)245-8000

June 25, 1981

Mr. Joel Worthaman
c/o Amalgamated Insurance Co.
770 Broadway
New York, NY 10003

Dear Mr. Wortham:

Please find enclosed the information requested on the fiscal costs of respiratory disease to the national economy.

The data derive from reports published by the Public Policy Laboratory at Georgetown University which projects direct and indirect costs of various diseases to the year 2000.

We would estimate that in 1981, a cost of $19.7 billion was attributed to diseases of the respiratory system, based upon direct costs of $7.6 billion and indirect costs of $8.5 billion related to morbidity and $3.6 billion related to mortality. If one were to include in the indirect mortality costs losses due to potential future earnings at a 10% discount rate, the total costs of respiratory disease could be as high as $48 billion.

For chronic obstructive pulmonary diseases, which include emphysema, chronic bronchitis and other chronic airways obstructive diseases, the costs are in the neighborhood of $5 billion per annum.

This estimate is derived from the NHLBI Task Force Report on Education, Prevention and Control of Respiratory Diseases. DHEW Publication No. (NIH) 78-1248 (1977).

Please contact us if we can provide any additional explanation of the enclosed.

Sincerely,

Berton D. Freedman

Berton D. Freedman
Associate Director,
Epidemiology and Statistics Unit

BDF/za

Founded in 1904, the American Lung Association includes affiliated associations throughout the U.S., and a medical section, the American Thoracic Society

Ms. WOYWOD. It is a powerful number. I was surprised when I got the answer.

Senator MOYNIHAN. We are used to saying $1 billion here and $1 billion there. Pretty soon you are talking about real money.

Ms. WOYWOD. That is right.

I would also like to say the members of my union, particularly in New York City, and the members of our sister union, the ITLGWU travel by subway to work. If they don't have a subway to travel on, they are not going to be able to get to Manhattan where they work from Queens and Brooklyn and they can't afford to live in Manhattan.

One of the resolutions in our environmental resolution this year in our convention was to ask for cheaper and safer transportation. It seems to me quite obvious that unless this Government makes a commitment to reducing clean air through mass transportation, transportation that is attractive to people because it is on time and safe and not so hot to ride in and the fare doesn't go up constantly, if we don't have that we are going to force people back into cars.

I can't imagine what New York City is going to look like if everybody is forced off that transportation system. Yet, unless there is a commitment by Congress to aiding these transportation systems, that is exactly what is going to happen.

There is another part to it, too. Young people are usually aware of this. We are in the apparel industry. Trucking is a major cost, especially in New York City, because without a rail freight connection into New York, which we don't have at the moment—and will not unless we get a railroad tunnel under the narrows to bring rail into the city. The trucking costs to our industry alone are about triple what it should be. The reason is not only is the congestion so bad, but in coming down from the George Washington Bridge to the apparel area, but once they get there, they can't park.

There is no place for them to stop. They just travel around and around. It triples their cost. The trucking industry itself agrees that they cannot handle this congestion problem. It is upping the cost to such a bad degree.

Thank you.

Senator MOYNIHAN. Thank you for a very helpful and direct statement. Yes, we allow applause at this hearing.

Our Canadian friends were well applauded this morning, so you, too, have been today.

Mr. Clancy, you are next, sir, on this list. We welcome you.

Mr. CLANCY. Thank you very much, Senator.

Senator MOYNIHAN. You are representing the New York Power Pool.

STATEMENT OF RICHARD C. CLANCY

Mr. CLANCY. My name is Richard C. Clancy and I am senior vice president of Niagara Mohawk Power Corp. I am appearing here today on behalf of the New York State electric systems who are members of the New York Power Pool.

The member systems of the New York Power Pool have developed a position paper on needed changes to the Clean Air Act. I have copies of the position paper with me today and I wish to present them to your committee for their consideration.

Senator MOYNIHAN. I am happy to do so, and they will be made part of the record (see p. 939).

Mr. CLANCY. I will just summarize, Senator.

Senator MOYNIHAN. Don't be in any hurry.

Mr. CLANCY. I have also brought along a position paper prepared by the Edison Electric Institute, dated February 1981, and entitled "Necessary Clean Air Act Amendments Affecting Stationary Sources." (See p. 943.)

These two documents set forth the position of the New York State electric systems of the New York Power Pool and the association of electric companies of the Edison Electric Institute. My statement today will briefly summarize the highlights of the New York State system's position on needed changes to the Clean Air Act.

The Clean Air Act, along with other environmental legislation enacted over the last decade, is an attempt to restore the environmental quality of our Nation.

Senator MOYNIHAN. The Edison Electric Institute, sir, could you describe the organization?

Mr. CLANCY. A national association of the electric companies.

Senator MOYNIHAN. A national association?

Mr. CLANCY. Yes, sir. I couldn't put down the list of names, it is too long, but it is a national association of electric companies.

However, in our zeal to restore our environmental quality, we have enacted some extremely complex legislation. The Clean Air Act is probably the most complex environmental law and needs to be changed in order to make it cost effective and workable.

The revisions proposed by the Electric Utility Industry will not compromise the basic intents and purposes of the act, but may significantly decrease the cost to New York's electric consumers, while helping to correct the act's unworkable administrative provisions. It is worthy to note that the electric utility industry proposed revisions do not differ significantly, and are generally consistent, with the New York State position on amending the Clean Air Act.

The New York State position was developed by the Clean Air Act task force and approved by the State's regulatory agencies.

The New York State electric utilities and other utilities throughout the United States are proposing modifications to the Clean Air Act which would remove unnecessary burdens, while maintaining protection of public health, welfare, and the environment. These modifications do not require major changes to the present regulatory structure, but promise real returns in terms of economic and energy growth.

Modifications to the Clean Air Act suggested by the New York State electric systems cover six major categories.

One. State discretion: Legally the State should be given authority to make reasonable adjustments of the State implementation plan without EPA approval, as long as all statutory requirements will be met. EPA's role should be one of auditing the State's programs to assure that Federal requirements are being met and to arbitrate disputes where the States are not able to properly resolve an issue. States, not the Federal Government, should be given the primary responsibility of implementing and enforcing the Clean Air Act.

Two. Coal conversions: The Clean Air Act now provides that a fuel conversion ordered by the Department of Energy shall not be deemed a modification which triggers new source performance standards and prevention of significant deterioration review. However, voluntary coal conversions are required to install flue gas desulfurization equipment. These units, which are often referred to as scrubbers, place an unnecessary and very expensive burden on conversions of existing powerplants. Oil to coal conversions should be allowed without scrubbers as long as primary ambient air standards are not exceeded.

Three. Standards-setting and rulemaking process: The process and basis by which a primary standard is established must be altered so that health risk assessment and cost/benefit tests are considered by EPA when establishing standards.

Similarly, secondary standards which are not health related must be viewed as guidelines or goals which the States may set, depending on local circumstances. It is critical that the EPA weigh all alternatives, taking into account economic, energy, and environmental considerations.

However, the act is now written to prevent such consideration. The New York State utilities propose that all regulations, prior to proposal, be evaluated by an independent scientific body to assure all pertinent factors have been weighed, the regulation is cost-effective and in the best interest of the country.

Four. EPA decisionmaking: Frequent changes in criteria and policies cause uncertainty as to the outcome of the approvals from EPA and thus foster delays in obtaining decisions and regulatory approvals from EPA. It is proposed that a statutory timetable be included in the act for all phases of EPA's decisionmaking process, similar to the deadlines established for the New York State agencies in Article 70, New York State environmental conservation law.

Five. Overlapping and unnecessary technical requirements: The Clean Air Act contains a staggering variety of technical requirements on new or modified sources of pollution. Our objective is to simplify current requirements by proposing changes to the prevention of significant deterioration program, new source performance standards requirements and tall stack provisions.

We believe these changes will yield identical environmental benefits to the present situation in a drastically reduced time frame and at a significantly lower cost.

Of significance in this category of proposed amendments to the Clean Air Act is a recognition of the ability of a facility to meet the new source performance standards requirements by bubbling the emissions from the new unit with those from existing units, as long as the total emissions from the facility do not exceed what would have been emitted if the bubbling option were not available.

This approach would allow greater flexibility, as well as cost in energy savings, without any increase in emissions or deterioration in existing ambient air quality. We believe the existing option now available to existing sources to bubble their emissions should be extended to include new sources.

Six. Interstate and long-range transport of air pollution: This morning's discussions centered about long-range transport and acid precipitation. The electric utilities suggest that the Acid Precipitation Act of 1980, which calls for additional study of this phenomenon, be used to develop a better basis of understanding so that effective action is taken if it is found to be needed.

Our basis of understanding is not advanced enough at this point in time to prescribe a cure for acid precipitation. Therefore, the electric utilities believe amending the Clean Air Act to deal with this issue is inappropriate.

We would offer that while the Acid Precipitation Act of 1980 possibly, we feel, put more money into it and to shorten the length of time that would be required to come up with that determination.

Senator MOYNIHAN. Are you aware that the administration seems to think that the best thing to do would be to put less money into the research over a longer period of time?

Mr. CLANCY. I am aware of that. I think it is a problem, Senator.

Senator MOYNIHAN. There is not much money involved in the first place.

Mr. CLANCY. No, but I think there is an area that we should put money into and speed up the results.

Senator MOYNIHAN. Good.

Mr. CLANCY. In conclusion, the Electric Utilities support laws and regulations protecting the quality of the air we breathe. We have difficulty in accepting laws and regulations hastily drawn, lacking scientific and factual bases for their determination.

Furthermore, laws and regulations should not be enacted that force technological improvements which are neither reliable nor cost effective. We believe that reasonable regulatory air quality requirements can be met through the application of existing and emerging technologies.

Thank you very much, Senator, for letting us present this testimony.

Senator MOYNIHAN. Thank you. That is the first time in awhile that anybody has come along and suggested that more money be put into one of my bills.

Mr. CLANCY. That wasn't done because you did that. That was a discussion we had yesterday.

Senator MOYNIHAN. No, I very much agree with that. May I make one point to the panel? Not wishing to elicit disagreement, but recognizing that views aren't always uniform, I suggest that those of you who testify, feel free to disagree with a fellow panelist and then we will have a chance for more rebuttals, if that is all right with each of you.

Mr. Chairman, you have to go at 3:30. I wondered if you wanted to address any questions to the panel now or do you want to wait? I know you have to go.

Mr. SCHEUER. Yes. I would like to address Mr. Clancy just very, very briefly. We are all aware that we have an imperfect knowledge base and an imperfect data base and that we need to do a great deal more in terms of research and development on the transport system, and all that——

Mr. CLANCY. Yes.

Mr. SCHEUER. What correlation there is between reducing the pollutants and reducing acid precipitation, finally, in the end result of improving the quality of our lakes and forests and cost and so forth.

Is it your position that we really shouldn't do anything now until that perfected research base is available? Should we have a cap on emissions? What is your feeling about—were you here this morning when the panel was present?

Mr. CLANCY. No, I wasn't, and I am not a scientist either.

Mr. SCHEUER. I am not either, so we are all in the same boat. Do you feel that we can move ahead in the next 3 or 4 or 5 years at least to do a little something in the way of trying to contain the problem until our data base is perfect?

What do you think we should do in the next few years?

Mr. CLANCY. I think we can move ahead. I am not really sure to name things that can be done. I think I would go to the other end and say what concerns us is a vast crisis, emotional reaction to something where a requirement would be placed upon both new and existing communities that might not be effective. It would be very costly, but it might not be effective.

I think, without kind of establishing what actually should be done, what we do should be something that we can make a determination, after a period of time. "Was it effective or wasn't it?" I think we all recognize that once something is in a regulation it is very difficult to get it out, even though it has been proven that it isn't as effective as that is intended.

I say that by qualifying I am not a scientist. I under- stand there is a problem, and I try and understand the problem. I am not sure I understand the transport situation, the chemistry of it all, but it seems to be one complex issue.

I am not completely sure that controlling utilities is going to control the problem. I would say if we are going to take steps, let's take some steps where once we have done something, we can make a reasonable determination if it was effective.

Mr. SCHEUER. I think we would all agree with that.

Mr. CLANCY. If you really look for what we would do, I can't come up with anything at this point.

Senator MOYNIHAN. We could reduce sulfur emissions, couldn't we?

Mr. CLANCY. There is where we get concerned. If you are concerned with reducing sulfur emissions by putting scrubbers on, it is going to be a very costly way to finding something out.

Senator MOYNIHAN. That is not the only alternative.

Mr. CLANCY. No, you can reduce it by sulfur content of the fuel or some requirement like that.

Yes, that would be one way to try and do it, see if that really happened. Again, I think this issue is so complex, you might have to take one step at a time. If you try to do two things in two different areas, you couldn't really tell where the effect was and where the cause was. It is a very complex issue.

I would have to go back and say, "I need more factual data to make a determination, but I think we need it a little sooner than what we thought before."

Senator MOYNIHAN. That is a fair point. An observation was made this morning that I think all the panel members would be interested in hearing. I know our distinguished Commissioner Flacke would be interested. We didn't know everything we needed to know about the phosphorous content of the Great Lakes about

15 years ago. We knew it was higher than it had been and higher than it probably ought to be. We took measures which, in retrospect, we are damn glad we did.

Mr. **Scheuer**. I might say, Mr. Chairman, that in the business community, I am sure that in your executive position you make decisions every day of the week; sometimes every hour of the day, based on less than perfect knowledge.

It occurs to me that business decisionmakers who function every day on less than perfect evidence would impose a far different standard on government decisionmakers, both in the executive branch and in the legislative branch than they are used to functioning in every day.

I am sure in the rough-and-tumble of your business life you generally, not frequently, but almost always make decisions based on less than perfect evidence.

It is the same thing on our side of the line, too. We do the best we can. We certainly hope to make decisions in such a way that, as experience improves, we can check that experience against the hypotheses and find out whether what we did made commonsense or not.

That is what cost-benefit analysis is all about. It is just adding up what it costs to do it and adding up the benefits of what you have done and seeing whether there was a reasonable relationship to what you have done. There is nothing esoteric about it. It is just ordinary plain horsesense. I think you use it every day, and we should, too.

We need to move forward in such a way so we can check realities with what our course was and check benefits, otherwise, go back to the drawing board.

Mr. **Clancy**. Obviously back up on the decision as we do in business if we find out it wasn't really in the best interest.

Senator **Moynihan**. Good point.

Mr. **Scheuer**. It doesn't really mean doing nothing until we find perfect evidence.

Mr. **Clancy**. I don't think we should do nothing.

Senator **Moynihan**. Thank you, Congressman Scheuer.

Mr. **Scheuer**. Thank you.

Senator **Moynihan**. Next, we are very honored to hear from Dr. Yeager.

Dr. Yeager, you are representing the American Lung Association. We welcome you, sir.

STATEMENT OF DR. ROBERT YEAGER

Dr. **Yeager**. I was actually representing the American Lung Association of New York State. I have been a past president of the American Thoracic Society. I have also been on the board of the American Lung Association for some 20-odd years at the national level.

Since May of 1942, I have been the medical director of a tuberculosis hospital which expanded to chronic pulmonary diseases in 1958 and subsequently to a county health center to which I am a director now retired. I am still a consultant of pulmonary diseases.

One of my charges was directing and working in an outpatient department for pulmonary diseases and observing the changing patterns of illness. With the decline of tuberculosis there was a rapid increase of patients of all ages, from infants to old age, with asthmatic bronchitis, bronchitis itself, and bronchitis with emphysema.

The impact of smoking on the progress of these diseases was recognized in the early 1950's. Just as an aside and on the question of waiting for research, prior to that time, our meetings looked like a smoke-filled room. Everybody in there smoked.

By 1955, it was rare to see a chest physician smoking at any meeting, long before the Surgeon General's viewpoints and any of the research that supported it so well was ever though of. Studies were started, particularly in England and in the United States on the effects of air—and I might add in Canada—on the effects of air pollution on patients, workers, and the general population groups.

The effect of local air pollution such as silica, beryllium, lead, on experimental animals and humans was very well known.

The effect of acute air pollution on communities had been described notably in Belgium in 1931; Danamora, Pa., in 1948; London in 1952 and 1962; and others. These were primarily due to sulfur dioxide. Excess deaths were noted particularly in older patients with previous cardiac and respiratory disease.

Subsequent examinations of those populations showed lasting adverse effects on those who lived through the acute onset. The reduction of ventillary function by exposure to even small levels of ozone have been shown; that is, photochemical oxidant and nitrous oxides.

More recently, Dr. Sellikof has published the long-term effects of exposure to asbestos with a long delayed period of 20 years between original exposure and the time one finds pulmonary changes appearing.

The very severe effects of hydrocarbons, vinyl chloride are now well known. The adverse effects of formaldehyde—its ability to sensitize certain individuals so that even exquisitely small exposures can produce severe effects has been proven. Meat wrappers asthma and asthma due to exposure to red cedars is now fairly commonly seen. The same has been seen with chlorine and other chemicals.

It has been shown that the effects of many of these pollutants are much worse in children, much worse in people with known asthma or allergic history and the aged, particularly those with chronic obstructive pulmonary disease or cardiac disease.

It has been shown that small exposures produce increased symptoms and disease in people with viral diseases and, as always, had a multiplying rather than additive effect on smokers.

With new chemicals being introduced into our environment daily, one cannot expect private industry to make all of the necessary physiological tests to be certain of their safety.

The Clean Air Act, since its introduction, has helped to control these dangers.

The official American Lung Association position on the Clean Air Act is this: it is necessary to maintain the setting of primary ambient standards to protect the health of all population groups with an adequate margin of safety.

Senator MOYNIHAN. May I ask you a question Doctor; I am sorry to interrupt. Would you be prepared to see this standard setting left to individual State governments?

Dr. YEAGER. No, sir; I would not. I will come to that in a moment, here in a statement I have made. I believe that since dirty air is worldwide and certainly blows from State to State and country to country that—and I live, incidentally to make it even more at home, on the junction of New York, New Jersey, Pennsylvania is only a few miles away, Connecticut a few miles the other way, and the whole city, metropolitan area, another way.

There is no way that one State can ever control everything in a mess like that.

I have centered my remarks on various proven adverse effects of acute exposure, but chronic pulmonary disease is one of the leading causes of disability with all of its attending costs. Chronic disease does not develop abruptly.

Carefully taken history shows that it frequently starts in infancy or childhood. It is characterized by repeated pulmonary infections. Symptoms are magnified by exposure to noxious fumes, cigarettes, repeated occupational exposure to toxic fumes in low concentrations, exposure to environmental trauma, the slow deterioration of pulmonary function which leads to disability or death.

It must be attacked from this viewpoint.

The Clean Air Act is an attempt at the Federal level to prevent this.

As I stated, dirty air recognizes no State boundaries. It can never be a local problem. It cannot be solved by local or individual industry. It requires an approach at the Federal level.

We maintain this, and I have attached the five steps which I will read briefly. This was adopted by the board of directors of the American Lung Association on February 6, 1981.

> The ALA supports the requirement of the Clean Air Act that the primary national ambient air quality standards must be set to protect the health of all population groups with an adequate margin of safety.
>
> Costs of attaining a national ambient air quality standard must be considered only in developing control strategies or determining a timetable for attainment.
>
> The ALA supports the development of a national ambient air quality standard for fine particles as expeditiously as possible. The Environmental Protection Agency should rapidly expand the research program in health effects of fine particles to support the standard setting process.
>
> The ALA supports specific provisions in the Clean Air Act to facilitate action by the Environmental Protection Agency to protect the public from hazardous air pollutants which have not yet been regulated.
>
> The ambient air quality standard setting process should continue to use scientific information that has been subjected to peer review.

In support of the opinions that I gave earlier, there is a booklet put out by the American Thoracic Society of the American Medical Section of the American Lung Association in 1978 in which they review 400 or so recent articles on the health effects of air pollution, all of which and more is, as I have said, discussed in great detail.

Senator MOYNIHAN. We will place it in the record. (See p. 956.) We appreciate it very much.

May I say, Doctor, before we move forward that this is not the first time today we have had the subject of fine particles raised. We are going to have to deal with fine particles just as we are going to have to deal with acid rain. Don't you agree, Mr. Chairman?

Mr. SCHEUER. It is a part of the acid rain phenomenon.

Dr. YEAGER. I was a little puzzled, if I may say so, by the statement about the lack of knowledge on humans of acid rain. If one defines acid rain, and I asked one of my friends just at lunchtime for the exact definition of acid rain, that is the only way I can explain it.

If one defines acid rain as acid rain that is developed coming out of the air as a certain pH, I must say I agree with it. I don't mind going out in acid rain; I don't think it would damage me. If, however, one defines acid rain in its broad definition, that is, excessive amounts of SO_2 and not just oxides as it was specifically this morning, and I am defining the customer of pulmonary pollutants and pulmonary disease and the excess caused in those areas in which pulmonary disease is so common, it is interesting to me that some of the Canadian studies were done in Sudbury and Montreal because our physicians picked polluted areas. They didn't pick acid rain areas which, I think, may have been because I don't believe that was in the general terminology before 1975 and most of these studies were done from 1960 to 1975.

That is just recently I have seen others in publications and newspapers on acid rain.

Mr. SCHEUER. How would you characterize the dry deposition?

Dr. YEAGER. The dry deposition? I don't know how to characterize that. I would like to have more studies on what it does. What I am interested in is not in what happens when it comes down. I am interested in what pollutes and causes the acid rain to begin with and what is entering my lungs at the same time as acid rain and is giving me and my patients pulmonary problems.

Dr. OPPENHEIMER. Would you object if I made a comment on that?

Senator MOYNIHAN. By all means comment.

Dr. OPPENHEIMER. I meant to say this this morning. It is interesting that there is epidemiological evidence, and I am no expert in that field, but I have read plenty of it.

There is epidemiological evidence, some of which has been reviewed by EPA, which shows that at sulfate levels which are equivalent to the amount that is carried interstate, in other words, just the long-range transport part, that there is health damage to vulnerable groups, which is small quantities of sulfate particles carried interstate and long-range transport and which are part of the acid rain problem are enough to cause health hazards. There is references in my testimony to that point.

Senator MOYNIHAN. Mr. Chairman, you have to go. Thank you very much for joining us. It was a great honor to have you. I know you will be holding more hearings on this subject.

Mr. SCHEUER. It was great being here.

Senator MOYNIHAN. Mr. Cerosky, we show you as representing the business council, as well as your own council, too.

STATEMENT OF ROBERT CEROSKY

Mr. CEROSKY. That is right.

My name is Robert Cerosky and I am manager of environmental protection and energy conservation services for the General Foods Corp. I am appearing here today as chairman of the Environmental Committee of the Business Council of New York State.

The Business Council of New York State represents more than 4,000 businesses and over 200 chambers of commerce throughout the State, in addition to representing all the small business councils which, again, go through the State.

The Business Council of New York views the present Clean Air Act as a laudable concept but one whose inefficient, inconsistent and overly complex requirements need to be reconstructed if the law's intents and purposes are to be met. From our viewpoint, the following issues identify the most serious deficiencies in the act that need redress.

I think at this point I would like to state that we are in agreement with many of the goals and many of the concerns for the health and welfare of our people. The question is how we get there and what it costs.

Senator MOYNIHAN. That is all right.

Mr. CEROSKY. Basically, that is what I will talk about. The first issue that we considered is the privacy of State administration. We feel that the States, and not the EPA, should be the key administrators of the act.

The present dual regulatory role is extremely inefficient and, in many cases, contradictory. We feel there is very much duplication on the part of what the State does at the Federal level in the approval process.

A State's implementation plan should be made the only binding approach to the control of air pollution at the State program level, and the goal of the State implementation plan is the achievement and maintenance of air quality standards after they are adopted.

The way each State accomplishes this goal should not be dictated by EPA. In other words, these are pollution control regulations, strategies, et cetera. The way each State accomplishes this goal should not be dictated by EPA but considerable flexibility should be allowed to the States in meeting health-related, primary air quality standards and basically, we feel that the thrust should still be at the Federal level for promulgating primary ambient air quality standards.

Senator MOYNIHAN. You think the Federal Government should set the standards? You think the States should devise the ways to meet them?

Mr. CEROSKY. That is correct, but there is an exception. That is the primary ambient air quality standards which are health related.

The secondary ambient air quality standards, we feel that the States should have that job to do. That relates to welfare.

Senator MOYNIHAN. The secondary standards should be the States' to set in your opinion?

Mr. CEROSKY. Yes. The act should be amended to clearly state this concept and those present portions of the act that contain the State's flexibility should be modified or deleted from the act.

We believe States should have a role to develop and adopt State implementation plans with removal of the very fine and delicate EPA approval procedures.

In other words, we are more interested in the substantive provisions, not in the lengthy, duplicating approval procedures which many times, these may end up in court and still delayed.

We feel EPA's role is to decide whether or not States are making reasonable progress toward meeting national ambient air quality standards.

The next issue is on air quality standards. We feel national ambient air quality standards, whose goal is to protect human health, are the basis of the air control program. We feel the standards are a means to identify where public health values are being adversely affected and to indicate steps that are needed to achieve these values.

Since we are continually studying both the causes and effects of air pollutants, these primary standards should be periodically revised. In other words, many of these standards we have today are 6 to 8 years old, and they are predicated on very weak scientific evidence.

We think there should be a review procedure so they are updated—as the doctor talked about here—where we are taking advantage of the latest scientific breakthrough and new discoveries.

EPA has not adequately considered new information that seriously questions new assumptions. Also, the process by which the standards are set needs to be altered to include the concept of binding peer review.

The act should be amended to include the concept of independent binding peer review based on health risk assessment and cost-benefit tests. Again, secondary standards which are not health related should be viewed as guidelines which the State should set and should not be mandated by the act, particularly from a Federal point of view.

The next issue to be considered are the administrative provisions. Since the State should be the primary administrator of the act, some of the administrative provisions of the act need to be amended to include the concept that EPA be a party to the State's implementation plan hearings.

In other words, they get involved up front not after the fact when it is submitted to EPA for approval, so that EPA's position is known before promulgation of the State implementation plan. If the State adopts portions of the State implementation plan contrary to the attainment of national ambient air quality standards, and the State should promulgate such contested State implementation plan provisions, this would constitute a basis for the EPA to veto the provisions of the State implementation plan.

We feel EPA must, however, veto those provisions in a limit. We are saying within 90 days of a State promulgation, primarily because there are some State acts that deal with a time constraint standard setting.

Also minor modifications to the State implementation plan; that is, variances, should be effective upon issuances by the State. We get into the whole question of some of these conditional variances that go into the State implementation plan. They float around. Really, industry or companies don't know where they are going and they are investing large sums of money with some pretty high risks of not being approved.

Only in the case where EPA can make a showing that such a variance would contravene primary standards would EPA have a basis for veto. These provisions are needed to obtain timely decisions under the act.

We note the State law in terms of timing initial instances of permitting.

Another issue is the burdensome technical requirements. There are a number that relate to nonattainment areas; attainment areas; that also include prevention of significant deterioration. Bear with me. I am going to use the acronyms——

Senator MOYNIHAN. All right.

Mr. CEROSKY. For these pieces.

Senator MOYNIHAN. BACT.

Mr. CEROSKY. We recommend simplified requirements. We think the program is very complex about the 1977 amendments, we suggest using BACT to replace LAER.

That is the best available control technology to replace lowest achievable emission rate.

We also suggest equating BACT to NSPS.

And another problem that industry, and we feel that we have been involved as a business, is EPA will use some of these new source performance standards when proposed, to write into permits.

We think that that is not according to Hoyle. We think actually, under the administrative act of our country, they should be promulgated before they are used.

That is another, we feel, bad practice, but it may be appropriate to mend the law that it properly does let something like that occur, and that the time period for a permit should be a minimum of 10 years after filing.

We think the 5-year permit limit—we have been through it now once; going on a second time. We think there is a lot of duplication of effort, and that only where things change and the laws pretty well read as to what is a modification of a change or a change that if there are these that that would require a new ordering of a permit.

We think that 10 years now seems to be a reasonable horizon. Something like 5 years we think is not cost effective. We would like to have that considered in any proposals to amendments of the act.

The PSD program is extremely complex, and PSD should only be a permitting process related to pristine or class I air quality areas established to protect unique resources. Mathematical models that are used in determining compliance or projected compliance can be useful tools; however, when measured data are available, these data should be used in preference to the models.

Let me just make a comment here: We not only find it on the air side but we find it on the water side, that we are making many assumptions that become, to many people, fact that are not in essence fact. We are using them in models.

They are formulas; very simply expressed to the oldtimers who went to school, they are formulas.

We find that these misrepresent many of the requirements or needs to do certain things that we are spending money that are becoming wasteful. We are recommending that some legislative change should be considered that brings things up to date, makes them current with data, not to let things slip 8 years or 10 years using the same assumptions that in many people's minds are fact, but they really aren't a fact.

The act needs to be amended to make this policy clear. Also, past practice of EPA using worst case situations should be made more reasonable since worst case rarely, if ever, occurs. LAER for major new facilities in nonattainment areas should be deleted from the act. Also, RACT, for existing sources in nonattainment areas should be tailored to the degree of nonattainment that exists.

In attainment areas, what we would recommend in the developing of the PSD for classes II and III regions, we feel that this problem should rely on BACT and preconstruction reviews. It should be left up to the States, not to EPA. We think it should be part of the State program.

Another issue is the long-range transport acid precipitation concern. This was with us today. We are concerned about this just as everybody else. Unfortunately, we feel very little is known and we are very interested in your comment that you don't particularly wait for all the answers to get in to do something.

But our recommendation is that acceleration of research is vital to a better understanding of the long-range transport acid formation and effects on transported pollutants before any rational regulatory scheme can be implemented.

Of course, there are certain scenarios on strategies that can go hand in hand. We are saying have a program that relates scientific discovery and information. Don't go down a road that you have your conclusion already set and your strategy is to say, "Spend a lot of money," and it becomes an expensive exercise in frustration.

We have been there before. The fluorocarbons is still one issue before the Congress. I recall sitting before the panels of New York State under the old legislature, JLC, where we convert from coal to gas in the seventies as a cheap, clean air pollution position.

It was economically viable. All of a sudden, people predicted in the seventies we are going to be out of gas by 1980. It got our whole energy policy and program in bad shape. What we are suggesting here is it is an issue. We have a concern, but let's make sure we know where we are going; we have some of the information in before we make some of the important economic decisions.

Enforcement is another issue that we would like to have looked at by Congress. We believe the air program would operate more smoothly if the States had the lead role in enforcement. We feel that the States have the compliance.

They go out and make inspections to plants. EPA does not have the staffs. They use EPA contractors which we don't think is a proper thing to do. That should be, if it is going to be done, it should be done by Federal personnel.

It is our view that the Clean Air Act should—we believe that the act should be amended to accommodate this proposal. Please look into the cost effectiveness of switching some of the Federal enforcement program to the State level, hopefully where the State can do it more cost effectively and more smoothly.

We feel partners of the State of New York and we commend New York State DEC on their programs, particularly when we know many of the constraints and the hardships that are endured under the present Clean Air Act and EPA approvals.

We think the State has done a good job here in New York State. We hope that they can get some relief under some of these amendments.

I have another section on hazardous pollutants, coal conversion, mobile sources, and the "bubble" concept. I don't want to repeat it because Mr. Clancy already talked about it.

One of the important points to us under the bubble concept is the program on averaging emissions from stationary sources, which Mr. Clancy talked about. The business council will provide your committee with a written statement in the near future detailing the items that you have touched upon here and more.

We believe the Nation faces an important challenge today; namely, to obtain a program that yields the greatest results from the dollar.

We read Governor Carey's statement this morning, and we are in support of his statement and, in fact, we support most of the items that the State DEC agency has talked about in recent months as far as amendments to the Clean Air Act.

Thank you.

Senator MOYNIHAN. Thank you very much, sir. We are sure to hear how the department of environmental conservation makes its laws, despite all the hardships imposed by the bureaucracies in Washington.

May I say to you I think that this point about the duration of permits may be a very reasonable position. As we learn more, we could have greater confidence in our judgments.

I would like to say, however, that there is some confusion about provisions in the Clean Air Act, as amended in 1977, that deal with setting national air quality standards. At 5-year intervals there is to be a review of the published criteria. This is section 109(d)(1).

Mr. CEROSKY. Yes; but our feeling is that that is not appropriate; that it should have more flexibility in terms of information rather than a timing constraint.

Senator MOYNIHAN. Have you ever tried to get a bureaucracy to do something more than once in 5 years?

Mr. CEROSKY. I know that, and I think it is very difficult. I think we have to look at the new horizons. We have become very much aware of a sophisticated world of instrumentation that was a fallout of the space program.

We are getting information at parts per trillion, parts per billion in air, water, and substances. I think we have to be more responsive. I feel that the public society becomes very frustrated because they don't see things happening sooner.

It is these kinds of things. Particularly, I am not a medical doctor, but I am an engineer, and I have many years working with medical doctors in industrial hygiene.

One of the things we try to capture is respond to new information quickly and try to get it out there. That 5 years may have been at the time of 77 the best shot from 1977, but I think in light of what is happening today, it may be a shorter period.

Senator **Moynihan**. That is a reasonable proposition and an empirical one. It is true that the space program has produced sensing devices that are much more precise, I gather, Dr. Yeager.

We have Commissioner Flacke and Commissioner Foshio waiting to testify, and I don't want to keep them waiting much longer. I do, however, want any member of the panel who disagrees with a statement made by a fellow panelist to feel free to say so.

Ms. **Woywod**. Senator, before I turn this over to Dr. Oppenheimer, who has a few comments to make, I want to point out that although primary health problems are, of course, our first concern, secondary are also, because it means millions of dollars.

In New York City alone, Dr. Lewin of New York University, who is the prime adviser to the city on restoring buildings, statues, and museums, has told me that the city has spent millions of dollars trying to hold back the sulfuric and nitrate acid attack on the buildings. We are now having to put a dome over the cloisters to save it.

It is ironic that they have existed for a thousand years and now, after a few years in New York City, it is crumbling to nothing.

Senator **Moynihan**. A dome?

Ms. **Woywod**. Yes. We have to or there will be no cloisters. George Washington, in Washington Park, has no face any more.

Senator **Moynihan**. Now, we have got to do something about that.

Dr. **Oppenheimer**. Senator, do you mind if I make a few additional remarks?

Senator **Moynihan**. Doctor?

Dr. **Oppenheimer**. From last panel before lunch, as environmentalists, we would not be opposed to occasional review of the standards, I think, especially in view of the latest fact on sulfur dioxide indicates the standard is set way too high. I think people from the business community would stand in back of tightening down on those standards if it really turns out to the fact that the standards are too high. I refer to the work of Dr. Sheppard, a point with regard to giving compliance over—compliance control over to States. The Ohio River basin energy study, which was commissioned by the Government, indicates, and this is relevant, indicates that if the SIP's in the Ohio River basin were enforced, take that as one case.

Take it as another case if the existing SIP's were not enforced. If you go to 1985 or 1990, there is something like a factor of two in the difference in SO_2 emissions. Now, the present SIP's are not being adequately enforced, given the combination of State and EPA effort.

If we turn the whole thing over to the States, I have great trepidation about what the enforcement picture will look like in 1985 and 1990, and the acid rain problem may well stand or fall just on—not on the basis of any new program, but on the basis of whether we actually get the present SIP's enforced.

If they are enforced the way they are being enforced today, the acid rain problem is only going to qet worse because of emissions from old utility plans. That is regardless of anything else that is done. The first thing that should be done is the SIP's should be enforced. Turning it over to the States looks like a procedure that will not move it in that direction.

The same thing goes with PSD requirements. If you drop out the PSD requirements, you are bound to make the acid rain problems worse.

Senator Moynihan. Dr. Yeager.

Dr. Yeager. I want to emphasize the fact that the Lung Association sees no method in which one can adopt primary standards in a "cost-effective" method. There is really no way that one can say what is the cost-effectiveness of human illness.

Do you put it on the $49 billion? We would sit here and argue for 10 years about what is cost-effective, but there is no such thing. We must protect human life and disability.

Senator Moynihan. That is spoken like a man who has taken the hippocractic oath.

I want to thank you all. Mr. Clancy, do you want to make any additional comments?

Mr. Clancy. No.

Senator Moynihan. I want to thank you all. You have been helpful. You have been forward, and you have been candid. Mr. Cerosky, do you have a report that you said you would get us?

Mr. Cerosky. Yes.

Senator Moynihan. Could I ask you to try to do that within 2 weeks. I want to get the hearing record together because we are hearing good testimony, and I want my colleagues to be able to read it.

Thank you, panel, most generously, and thank you, Dr. Oppenheimer for coming back twice.

Dr. Oppenheimer. Thank you for letting me speak twice.

Senator Moynihan. Now, to conclude our hearing, a respected public servant who is responsible for the New York State Department of Environmental Conservation, Robert Flacke; my good friend, Leslie Foschio, the distinguished commissioner of motor vehicles for New York State, and Marcia Cleveland, the assistant New York State attorney general in charge of the environmental protection bureau.

First, Commissioner Flacke. We welcome you.

STATEMENTS OF ROBERT F. FLACKE, COMMISSIONER, NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION; LESLIE G. FOSCHIO, COMMISSIONER, NEW YORK STATE DEPARTMENT OF MOTOR VEHICLES; AND MARCIA J. CLEVELAND, ASSISTANT ATTORNEY GENERAL, ENVIRONMENTAL PROTECTION BUREAU, STATE OF NEW YORK

Mr. Flacke. Thank you very much, Senator. We prepared and have submitted testimony this afternoon.

Senator Moynihan. It will be in the record. (See p. 1015.)

Mr. Flacke. It is for the record. I will not read that today, but I would like to essentially summarize some of the points that we have and make some personal observations concerning the Clean Air Act and then acid rain.

First of all, I would like to publicly thank you for the work that you have done on acid rain and the Clean Air Act, and especially in getting the money for this country to—the first time recognition of this problem. You certainly are to be thanked for that.

Our Governor, again, has acted in quite a capacity in getting the coalition of States together to find a consensus of agreements throughout the country and finding a solution for both acid rain and the Clean Air Act.

But there are many other New Yorkers also who have, for a long period of time, labored in the vineyards, if they have been in the minefields, Anne LaBastille, Marty Pfieffer, who is with us today.

Pete Coffey, which you have also heard from. We noted the loss of the Adirondack lakes and their continued deterioration. We also reviewed in the testimony our fine particulates and how we completely understand how that is the emerging issue where we have evolved ourselves into great discussions over sulfur and some of the other six criteria pollutants when, in reality, most of the people know that the fine particulates issue is one that is emerging as a very great hazard.

Senator MOYNIHAN. We are beginning to sense that.

Mr. FLACKE. We have reviewed previously and with you before that we can do something in this country right now, and that is coal washing, where we can get basic reductions of between 10 and 20 percent of sulfur loading and small particulates through this process. We have also known very well that the health issue is emerging very quickly. We know that this equitably and consistently has been brought out even by the previous panel where if the SIP's were adhered to in the Ohio Valley and if there was equity in the regulations of tall stack standards and so forth, that we would not have this economic imbalance between one part of the country and the other, causing us great political strife.

Senator MOYNIHAN. I feel I have to interrupt you, if I can, to say that your written testimony, so our audience will know, makes the point that the sulfur dioxide emissions from New York and seven neighboring Northeastern States combine to some 2 million tons annually, as contrasted with 3.9 million tons from the single State of Ohio. I think that is a very dramatic fact.

Mr. FLACKE. Yes, it is, and I think that those numbers are very conservative, very conservative, Senator.

Several weeks ago, I read that a newly appointed government official was discussing the Adirondacks and felt that perhaps it was time that we could trade off some of these beautiful lakes in a cost balance with the needs of the country for electric power.

Of course, those of us who live in the Adirondacks and those of us who live outside the Adirondacks know it and love it and protect it took great umbrage with these remarks.

However, in our final conversation, if we are really talking about costs, I thought that perhaps I would try to explain to you how many Adirondackers think about that, and I do live within the Adirondacks.

For over 100 years, we in New York State, both in and outside of the Adirondacks, have spent hundreds of millions of dollars, and perhaps tens of millions of dollars. We have spent over $15 million a year in taxes to local governments to support the land that we have purchased. We have, for well over 100 years, acquired from a very small number of acres, to the many thousands of acres to create this.

There is very little difference between the Adirondacks and, say, a very large Air Force plane. If you take the lakes away from the Adirondacks; you can take the wheels away from an Air Force plane. When we talk of the Statue of Liberty, for us and the Adirondacks, it is losing those lakes. It is like losing one of the arms. If we added up that money that we have put into the Adirondacks, added up all the time and effort and the constitutional conventions, the time when you were secretary to the Governor, that issue was fought again.

For well over 100 years represents over billions of dollars. Let's set it down and cost it out. Is the Federal Government willing to pay billions of dollars for those lakes? I don't think they are.

I think that we in New York don't look at it through that cost ratio, but if one wants to look at it through that cost ratio, the bill, we think, will be very high.

I would like to emphasize the fact that we concur with you, that coal washing is something that can be done now. It does not require a large amount of discussion. It has benefits even by the power industries themselves in getting rid of the impurities to be used for coal for a wide variety of reasons.

Why should we transport it to the utilities? Why should we do all these things? A national coal washing policy has many, many more benefits than just for the electric utilities, many more benefits than just for reducing the amount of sulfur coming out. As a national policy, it can be done. We urge that as an immediate step that that be done.

We, as you know, have the Governor's program in trying to get the coalition of States. Hopefully, that, combined with the attorney general's program, Ms. Cleveland will outline what we think is an effective New York State strategy.

I guess last but not least, I and I suppose on a personal basis, acid rain hit home last night. My mother-in-law, Agnes McNinny, came into the house with a letter from Cornell University describing the fact that why her cucumbers would not grow last year was because of acid rain.

That, of course, has a very personal effect upon me because once my mother-in-law gets after me for an environmental issue, it gets very big.

Senator Moynihan. What is the specific allegation?

Mr. Flacke. Last year the cucumbers didn't grow because of acid rain and they are very sensitive to it, which is a new bit of knowledge to me.

Senator Moynihan. This has got to have more consequences than we know; yet we are not just talking about brown trout and red pines. That is what we seem to know about, but there has got to be more than that.

Mr. Foschio, we welcome you. This is the first time we have heard you before this committee.

STATEMENT OF LESLIE G. FOSCHIO

Mr. Foschio. As commissioner of motor vehicles, one of my principal responsibilities is the administration of the newly implemented program for vehicle emissions inspection and maintenance in the New York metropolitan area, a nine-county region that includes, New York City, Long Island, and the neighboring counties of Westchester and Rockland. The area, as you know, is one of the most populous in the United States. The more than 4 million motor vehicles registered in the metropolitan area comprise virtually half of our 8.5 million statewide total.

Because of the importance of regulating the emissions from those vehciles, we welcome this opportunity to share our views with you, and to provide some background on the New York experience.

If I may comment, our interest here is to explain to you the workings of a specific program that has been implemented under the requirements of the Clean Air Act; one that touches the lives of a great number of New Yorkers and citizens in areas that they are concerned about to give you some sense of the operational aspects, the impact, some of the problems that we have encountered and some of the accomplishments that we have made during the implementation phases thus far.

Our State, as you know, has been concerned over auto exhaust pollutants since the early 1960's, when civic leaders began exploring the health hazards posed by concentrated smog and atmospheric inversions over heavily populated areas.

The mayor of New York, at that time, for example, created a special task force on air pollution in 1965 to help the city prevent the type of tragedies caused by severe air pollution episodes in London, the Meuse River Valley of Belgium, and as was mentioned earlier, in Donora, Pa.

A key finding of that task force was, and I quote, that "of all the poisons in the city, none exists in greater profusion than carbon monoxide. From every car, bus, or truck operating daily in New York City," that is to say during 1965, "more than a ton of carbon monoxide was produced."

That study and similar efforts found that people with emphysema, asthma, hay fever, and other respiratory diseases are hardest hit by episodes of heavy air pollution.

Partly as a response to those efforts and to recommendations by the Department of Motor Vehicles, the State enacted legislation in 1966 granting initial authorization for an emissions inspection program should it be subsequently required by law.

Following passage of the Federal Clean Air Act in 1970, New York State began to explore feasible program options and methods of testing. This research was assigned to two State agencies:

The Department of Environmental Conservation, which established the standards for permissible levels of tailpipe exhaust pollutants; and the Department of Motor Vehicles, which licenses the more than 4,100 vehicle safety inspection stations in the Metropolitan New York area.

The goal of this cooperative effort, both then and now, is the effective reduction of auto pollution without any restriction on automobiles. Despite the benefits to be realized by achieving that objective, the concept of emissions control has not attained united support within the State legislature.

Ultimately, in 1979, Governor Carey took the initiative and authorized implementation of the emissions control program by invoking the provisions of the 1966 State law, New York Vehicle and Traffic Law, section 301(c), which authorized the Department of Motor Vehicles to implement emissions testing provided that it be required by Federal law or any rules or regulations pursuant thereto.

A startup appropriation of $1.2 million was approved for the 1980–81 fiscal year to establish a task force and hire field personnel to monitor the inspection stations.

However, this support was eliminated in the 1981–82 budget, as finally adopted by the legislature and has left the program underfunded in several essential areas. As a result, we have had to limit the development of highly desirable consumer protection measures and defer program monitoring to some extent.

In the meantime, implementation has proceeded with the investment of more than $24 million in testing equipment by the participating inspection stations, who will ultimately have to spend some $52 million for program costs, including servicing for the testing machines.

With their cooperation, however, the program was initiated last January. It applies to gasoline-powered vehicles weighing up to 8,500 pounds, and it utilizes a computerized testing machine that automatically measures the level of air pollutants emitted through the tailpipe of each vehicle tested.

During this initial year of the program, the motorist is merely being advised as to whether or not his vehicle complies with the State emissions standards. Should the vehicle fail the test, the motorist is alerted to the advisability of repair, but no action on his or her part is required.

This will change on January 1, 1982, which is 7 months away.

Beginning then, any vehicle that fails the emissions test will have to be properly repaired and pass a second test before it can be registered in New York State.

Now that the program has had a 6 months' trial period, with over 1.7 million vehicles tested, it is producing some interesting results. We have found, for example, that in terms of exhaust pollution many vehicles are dirtier, if you will, than they were designed to be.

Although, for example, some 1980 models tested thus far have shown a zero percentage of carbon monoxide emission and a hydrocarbon level as low as 5 parts per million, we also have discovered other 1980 autos emission more than 7 percent carbon monoxide and a hydrocarbon concentration of over 700 parts per million, which is well above design limits.

Senator MOYNIHAN. Could I interrupt you? Do you find a pattern of makes or models in those?

Mr. FOSCHIO. So far as I know from the information I have from staff, I don't recall any. I would be willing to provide a detailed analysis of that.

This finding suggests that the pollution control systems on new cars rolling off the assembly lines may meet Federal standards, but their effectiveness can deteriorate to the point where adjustment and repair is required. This is one more indication of the need for an ongoing emissions inspection program.

Another finding of interest is the fact that, as predicted by the Federal Government, an effective emissions testing program can be implemented for less than $10 per inspection. Here in New York we have found that the use of a sophisticated testing device, designed to our specifications, has enabled us to conduct these tests for only $6 per vehicle.

Senator MOYNIHAN. Very nice.

Mr. FOSCHIO. Further, the results thus far appear to indicate that the cost of emissions repair, if done competently, will be offset by improved vehicle efficiency; that is, greater mileage for your gasoline dollar.

Perhaps the most encouraging result was the response to a public opinion survey on air pollution and the automobile's role, which was conducted for the department last December in the metropolitan area.

The majority of the people interviewed in that survey expressed the following views: First, they are concerned about air pollution; second, they feel that auto emissions are a major contributor to that problem; and third, there should be some type of follow-up to the manufacturers' efforts to reduce auto pollution, such as an emissions inspection/maintenance program.

National reports tell us that this is the best way to attack the problem, for we are all aware of the encouraging results thus far in Arizona, New Jersey, and similar areas. In Portland, Oreg., for example, the pollution from 1975 through 1977 model vehicles has been drastically reduced, with carbon monoxide emissions down 34 percent, and hydrocarbon emissions down 24 percent.

This leads us to believe that New York can achieve its goal of an overall reduction in auto pollutants of 25 percent by 1987. We feel we have the basic framework to do this:

Computer controlled testing; frequent machine calibrations; frequent monitoring of more than 4,100 inspection stations, presently cooperating or participating; rapid response to solve consumer problems; over 1.7 million tests conducted with no appreciable objection from consumers; and a public information program serving to educate both the consumer and the mechanic to the need for the program itself, for the fair practices expected, and for good repair to reduce auto pollution.

I might say about that computer control testing, Senator, there is a permanent device attached to the machine which records the information given to it in terms of the auto, the make, the year, et cetera, which then can be monitored by the Department of Motor Vehicles as a safeguard against tampering or revision of the equipment itself. In other words, if the incorrect information is put into the machine, it will give an invalid test, and it will be permanently recorded. So we have a way of monitoring how the machine is actually being implemented in the field. Some people have a popular misconception that the machine can be somehow evaded.

In our opinion, this is very difficult to do, and since there are all kinds of sanctions associated with that effort and we do have auto facility investigators and inspectors in the field to monitor this, we feel that there are plenty of safeguards in terms of the antitampering aspect of the program, which is very important to keep in mind.

I know that your analysis of this and similar programs is part of your responsibility for questioning the advisability of spending Federal funds for emissions control programs and where those funds can best be spent.

We cannot of course establish Federal priorities, but we can offer our suggestions to help your efforts to do so by identifying our needs in this area.

We know, for example, that New York will continue to require assistance and funding for mechanic training programs. As you know from the Senate's own studies dating back to Senator Philip Hart's Commission, the auto user is facing a large program of unnecessary and inadequate repairs. We feel this problem will be underscored as jurisdictions implement emissions control programs.

We also note that new vehicle technology has frequently outstripped the training and knowledge of a large portion of the mechanics working in this field. Our mechanics in New York have become painfully aware of this fact because so many of them have never taken training to correct vehicle emissions problems.

Beginning next January, they will have to make such repairs, so it is contingent upon us to address the needs of the mechanic. We must not only provide the necessary technical training, but we must also inspire the interest of the mechanic in making this program a success through careful and professional repairs.

My point here simply is that as we implement a progran of this character, we must be aware that there are ancillary problems in respect to the private marketplace upon whom we rely to carry out the necessary mechanical procedures. What we are finding is that there is a great need to upgrade the competence level of the existing force of mechanics in the field.

In addressing this question, the Federal Government should be well aware of that.

We also need Federal guidance and support in such critical areas as public information and the coordination of regional efforts, which has been alluded to quite articulately earlier.

We would welcome legislation to require emissions control programs in those large urban areas with severe smog problems, for we recognize that our own success in combating air pollution, auto pollution will largely depend on the parallel efforts of our neighboring States. Some of them, such as Massachusetts, Maryland, and Pennsylvania, have yet to implement an emissions program.

First and foremost, the State government should have at this time a Federal reaffirmation that emissions inspection and maintenance is an important element in the national clean air program, and that it is the best strategy for reducing pollution by the vehicles in use.

Here in New York we have implemented an exemplary program.

We have made a major commitment of personnel and materiel; we have enlisted the cooperation of private industry in making a $50 million investment over a 6-year period; we have begun a training program; and we feel that we have developed and implemented an emissions control program that is as simple and as efficient as it possibly can be.

In short, we have the tolls and basic knowledge to do the job, but we should have also the support of the Federal Government if we are to preserve clean, safe, and breathable air for the millions of residents and visitors to the New York metropolitan area.

Senator MOYNIHAN. Well, we are much in your debt Commissioner. That is a nice piece of public administration. You have inspected about one car in five in this State in the last 9 months or so?

Mr. FOSCHIO. Approximately.

Senator MOYNIHAN. As you say, with no public outcry. Starting January 1, it is obligatory. What is it, once a year?

Mr. FOSCHIO. Once a year in conjunction with the expiration of their inspection, which has to precede, as you know, the re-registration of the vehicle.

Senator MOYNIHAN. Good. I want to particularly congratulate you in terms of thinking of the mechanics. That is a great work force.

In particular, you had a sample of 1.7 million cars. I think it would be fascinating to explore if there was a pattern of some make, some models which held up to their design standards and some which didn't. That is how you learn things when you have a natural experiment out there.

Mr. FOSCHIO. We will be happy to share any relevant information we have. I hadn't thought of bringing that much detail with me this afternoon.

Senator MOYNIHAN. Don't you agree, Commissioner, that you might find out something? Either way, you will know something. If it turns out there is no pattern, then you have learned something, or if it turns out there is, you have learned something else.

Mr. FLACKE. We have been waiting to read the details of it, and we have been contributing and operating with the Department of Motor Vehicles. It is true.

Senator MOYNIHAN. You set his standards?

Mr. FLACKE. Yes; and we run some of the test stations back and forth. It has truly been a cooperative effort. We are waiting to find out exactly how it is all going to mesh together, whether there is a difference between Suffolk County and Metro New York. We have got all the statistics that we can rattle out over the next year and get some interesting things.

Mr. FOSCHIO. For example, a somewhat popular misconception is that the New York City taxicabs are exempt. That is not true. They actually are inspected in a much more stringent basis, actually three times a year by the Taxi-Limousine Commission, but that is supervised by the other Department.

The information requested will be prepared under the careful eye of my able deputy, Commissioner for Operations, James McGirk, who is here, who really leads the charge on this whole program. He has been on the point, as it were, for many months putting this program together. He deserves a great deal of the credit for its success thus far.

Senator MOYNIHAN. It is typical of you to want to share the credit. I think that you are absolutely right that auto emission control is central to the Federal approach to clean air. It should be so restated.

Mr. FOSCHIO. That is our major message to you this afternoon, sir.

Senator MOYNIHAN. It is understood.

Ms. Cleveland, you are next.

STATEMENT OF MARCIA CLEVELAND

Ms. CLEVELAND. The first thing I have to say about suing the Federal Government is I know there is a credit for giving the lawyer, essentially, everything that the Attorney General does. In the environmental area, we are very dependent upon our agencies for the technical support. Especially in the acid rain area, you have to remember that the Department of Environmental Conservation and the Adirondack Park Agency did a lot of the original research that demonstrate the existence of a phenomenon and were consequently the basis for the litigation, so they get credit, too.

Mr. FLACKE. Thank you.

Ms. CLEVELAND. We sued the Federal Government; I could tell you why.

Senator MOYNIHAN. Go ahead.

Ms. CLEVELAND. I think one of the things that we discovered when we first looked at the act was to see there were ways to address the act through debates was there were many provisions in the existing act with which EPA could solve the problem if they wanted to solve the problem, but essentially, they had mounted one failure upon another. The result has been that they have done nothing and, in fact, the litigation tools aren't as good as they would have been if EPA had done its basic job.

The first thing EPA failed to do—and this is part of something that is part of our recommendation on the interstate pollution section—is under the 1977 amendments—they were required to review all SIP's for compliance with the new list of requirements in section 110.

To the best of our knowledge, they never reviewed the SIP's for their compliance with the interstate section, which was new that year.

In other words, Congress told EPA, "Look at all the SIP's and look at the interstate impacts." To the best of our knowledge, they never really did that. What we typically find in SIP's from the Midwest—and I am sure Commissioner Flacke knows in more detail than I do—is that monitoring of pollution is only done, what is it, 15 kilometers from a site? In other words, they don't even ask for data about pollutants further away from sites, so how can you even tell anything about interstate pollution?

That was the first filing. The second one, which is a large part of my testimony, is that EPA has never promulgated the national ambient air quality standard for fine particles.

Senator MOYNIHAN. Right.

Ms. CLEVELAND. Fine particles are contributors to an awful lot of the problems that we find in New York and play a major role in interstate pollution. Fine particles are the sulfates and nitrates which become acid rain or—my scientists keep telling me to say acid deposition because it is as bad for us if it falls down dry as if it falls down rain.

I will use the term acid rain. By that, I mean all of those categories of things.

Fine particules also include toxic pollutants which have been poorly regulated by EPA. They also cause visibility problems. This is as much a problem in the rural area of the State as it is in metropolitan areas. Of course, they contribute to very significant health problems where they are found in their greatest concentrations, which are usually in metropolitan areas.

They come from coal-fired facilities, but they also come from automobiles, and they come from, in particular, a diesel. As this country changes more and more to the use of diesel vehicles, we will be faced with greater and greater problems associated with fine particles.

At present, EPA regulates fine particles under what they call their total suspended particulate standard. Now, the total suspended particulate standard is based on weight. It is designed to cover everything, everything from the dust you used to get in the city, which has somewhat improved now, but the kind of stuff that piles up on your window sill and is thick and sooty and black. Those are the porous particles.

Because it is based on weight, it is very sensitive to very big changes in the fine particle fraction, because fine particules are a million units of a big particle. You can have either a very minor violation of the TSP standard or no violation at all associated with tremendous increases in fine particles.

The only mechanism that EPA has for getting those fine particles is admittedly inadequate. In fact, in 1969, when the TSP standard was first proposed, EPA admitted that it would not cover fine particles, and it also adnitted that even back then they knew that fine particles were the worst part of the health problem.

One of our specific recommendations for the reenactment of the Clean Air Act this year is that section 109, which governs the promulgation of NAAQS—you said it was OK to speak this jibberish—should contain specific provisions requiring EPA to promulgate a national ambient air quality for fine particles.

If we have such a standard, both a primary standard designed to protect health and a secondary standard designed to protect other environmental impacts, it should be set at a higher level which will facilitate our control of the acid rain problem and protect us from what we now know are the very serious health problems associated with breathing fine particles.

Our second area of concern is hazardous pollutants. Since the 1970 act was passed, EPA has only regulated four hazardous air pollutants. It has listed three more that it has listed for eventual regulation.

As to the three that have been listed, EPA has missed its deadline for regulating promulgation by a matter of years. Once the access is listed, it must be regulated in 180 days. Of the three listed chemicals, only one has a proposed regulation. That is benzene, and benzene has been on the list, I believe it is 3 years, so they are way behind even on those substances they list.

That is a problem of EPA complying with the mandate.

Senator Moynihan. The law is fine.

Ms. Cleveland. That is right. That may be a kind of problem the Congress should deal with in an oversight hearing which is EPA consistently missing these deadlines. There is a larger problem of amending that section.

Under the section as it is now written, EPA has no obligation to look at all of the potential toxic substances in our air and figure out which ones need regulation; which ones truly pose a risk to human health; and are they in sufficient quantities for us to worry about?

In some recent testimony an official of EPA has admitted that EPA has identified 632 organic chemicals in the air which are potential toxic pollutants. There is no mechanism in the act now to force EPA to sift through that list and decide which ones are important and which ones are not.

The specific suggestion that we make in our testimony is that Congress consider a system very much like section 4(e) of the Toxic Substances Control Act. You may not remember the section of it, but you may remember the system.

Under the TSCA, as it is known, there is an interagency committee that was established to look at all chemicals which are currently being produced by the chemical industry. That committee came up with a priority list. Once the committee puts a chemical on the priority list, EPA has one year in which to decide whether or not to issue a testing order, which is the main regulatory tool under that act.

The parallel which I think could be applied here is to have either the exact same committee that does it for TSCA do it for the Air Act or a new committee look over those 632 chemicals; come up with a priority list of 50 and give EPA a year to decide whether or not it is going to issue an emission limitation on 50 priority chemicals. If EPA decides to issue an emissions limitation, it would have the usual 180 days.

If EPA decides not to issue an emissions limitation on a priority chemical, it would have to give explicit reasons why it had decided not to adopt the committee's recommendation.

Senator Moynihan. I understand.

Ms. Cleveland. That is a system that leaves EPA some regulatory discretion but it gets the ball rolling.

When it comes to setting emission limitations for hazardous pollutants, under the current act, they are supposed to be set at a level to protect human health at the necessary margin of safety. We feel that that concept should be supplemented with a notion of caps on total emissions. The situation that we now have is that toxic pollutants, even if they are subject to an emissions limitation, can add up to a very heavy load, which endangers human health, but there is no limit on that load.

The classic example of this is in northern New Jersey, where, as you probably know, the citizens of Staten Island are probably very concerned about because they are downwind. The concentration of smelters and refineries in northern New Jersey emit a lot of toxic pollutants, even if one of the pollutants that they emit has a limit on it, there are so many companies there emitting it, the total load for the people of New Jersey and New York City could be unacceptably high.

Senator MOYNIHAN. Right.

Ms. CLEVELAND. We also suggest that where a health protective emissions level is not achievable technologically, that the industry be required to use something like best available technology or reasonably available technology, some such formulation; in other words, that it go to a technology-based standard if the health protective level cannot be achieved by present technology.

Our final set of recommendations pertain to the interstate pollution sections in general and acid rain in particular. Many of these ideas come from our efforts to get a handle on this problem by way of litigation.

First, we recommend that Congress, once again, require—and this time I think they should explicitly focus on interstate pollution—explicitly require EPA to review all SIPs for their compliance with the interstate pollution sections.

In other words, "Go back and do what we told you to do in 1977 and you didn't do."

The reason I think it is important for you to do that is because if there is a mandate in this act, it will be clear that there is something legally enforceable.

Also, EPA should be required to take interstate impacts into account in setting national ambient air quality standards. The way the NAAQS's were set, they typically did not take into account downwind effects.

For example, the secondary standard for SO_2 does not really take into account what we are now realizing is its major environmental impact; namely, acid rain many miles away from the site of the emission of SO_2.

In other words, instead of just looking at a pollutant and finding out what that pollutant does to the health and environment, EPA should look at what that pollutant does after it is transformed in the atmosphere into all other sorts of pollutants as well. That has been one of the big problems in getting a handle on the acid rain problem under the current act.

Also, section 126, which is the section that allows a State to bring an action before EPA against pollution from another State, should allow that State to go after pollutants, even if they are not governed by national ambient air quality standards.

This is one of the things that happened to us with acid rain. Because there isn't a fine particles standard, we are forced to complain that Ohio is interfering with our compliance with TSP, because the TSP standard is inadequate.

This whole situation is essentially a catch-22. What all of our recommendations focus on is to try to force EPA to break out of that catch-22 so that we can get better relief under the provisions of the act.

Senator MOYNIHAN. We thank you very much. Your ideas about how to improve the EPA performance are altogether admirable.

I thank you very much. We very much appreciate your testimony.

We thank our valiant reporting secretary. I would like to thank Ms. Cudlipp and Suann here and thank all of you who have been so thoughtful. We declare the hearing to be closed. Thank you very much.

[Whereupon, at 4:40 p.m., the committee was recessed, to reconvene subject to the call of the Chair.]

[Statements and other material supplied for the record follow:]

NEW YORK STATE
POSITION PAPER ON THE
CLEAN AIR ACT

Hugh L. Carey, Governor

Brad C. Johnson, Director,
Washington Office

CLEAN AIR TASK FORCE

Robert F. Flacke, Chairman
Commissioner
Department of Environmental Conservation

David Axelrod
Commissioner
Department of Health

Paul L. Gioia
Chairman
Public Service Commission

William D. Hassett, Jr.
Commissioner
Department of Commerce

William C. Hennessy
Commissioner
Department of Transportation

James L. Larocca
Commissioner
State Energy Office

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AMENDING THE CLEAN AIR ACT

I. RATIONALE FOR REVISING THE CLEAN AIR ACT

The Clean Air Act of 1970 was originally adopted because of the perception that some areas of the country were doing little, if anything, to control air pollution, while other areas were moving ahead vigorously. A basic although unstated precept was achievement of environmental and emissions equity with some allowance for states to fine tune programs consistent with the individual state's economic and environmental needs. Unfortunately, the Clean Air Act failed to achieve either of these unstated goals and, therefore, it was amended in 1977. Instead of addressing the deficiencies, the 1977 Act amendments actually created even further inequity, both through its administration and in legal and judicial interpretations.

To make the Clean Air Act a viable tool for protecting the nation's environment without causing severe economic hardships and without imposing administrative and bureaucratic impediments toward speedy implementation, the Act should be changed to correct the following deficiencies:

1) It fails to adequately address long-range transported air pollutants, such as acid rain, fine particulates and ozone.

2) It allows for - or even requires - extreme differences in control from one area of the country to another, thus creating inequitable economic differences.

3) It contains standards - i.e., PSD increments and motor vehicle emission requirements - which should be in regulations, not in law.

4) It establishes a complex mechanism - the SIP process - for dealing with pollution control that has led to administrative and procedural requirements which are time-consuming and focus on the least hazardous pollutants, while the more dangerous pollutants are almost neglected.

5) It procedurally and substantially makes conversions to alternate energy sources - especially coal and wood - difficult, if not impossible.

6) It treats new source review in non-attainment areas substantially different from attainment areas in such a way as to exacerbate the economic plight of urban areas.

7) It has been used as a vehicle for social reforms over and above those related to achievement of clean air - i.e., incorporation of basic transportation needs into the SIP approvals when the majority of basic transportation needs are related to issues other than air quality; and the requirement for transportation control measures in the name of air quality improvement which in fact produce little, if any air quality improvement but, rather, get at the root of other social and political needs which are totally unrelated to air pollution control.

II. ISSUES AND SOLUTIONS

The major issues of concern to New York State and solutions to help resolve the deficiencies in the current Clean Air Act are discussed in the attached issue papers. These are discussed primarily in the order in which they currently are addressed in the Clean Air Act, but not necessarily in the order of priority to New York State.

This document is the result of a great deal of work performed by Governor Carey's Clean Air Act Task Force, an interagency body composed of representatives from the Governor's Albany and Washington Offices, the New York State Departments of Commerce, Environmental Conservation, Energy, Health, and Transportation, the Attorney General's Office, the Division of the Budget, and the Public Service Commission.

FEDERAL GRANTS FOR AIR POLLUTION CONTROL PROGRAMS

Problem

Section 105 of the Clean Air Act provides for grants to support air quality planning and control programs, with funding being available for planning, developing, establishing, improving, or maintaining programs for prevention and control of air pollution or the implementation of national primary and secondary ambient air quality standards. A clause in this section requires that federal funds be terminated if a state cuts its share of the funds.

Solution

Amend the Act to provide for a matching formula to all state air pollution control agencies to be paid upon quarterly indications of expenditures by the agency for air pollution control programs agreed to between the state and the Environmental Protection Agency (EPA) in the annual State/EPA agreement. Assume that any cut in state funds would be matched by no more than a comparable cut in federal grant funds, not in a complete loss of the grant.

Rationale

This would protect an agency against any loss of funds, since it would still receive the same percentage of federal dollars--regardless of the amount of state or local dollars expended. It would also be assured of an adequate level of federal funding commensurate with the level of state funding. This program could be funded at 50 percent of the total expenditures of state and local air pollution control agencies and probably would not cost Congress more than is currently authorized ($87.7 million budgeted in FY 1981, with the same amount proposed in FY 1982) for air pollution grants. It would also do away with the expensive grant mechanism and bureaucracy currently set up within EPA.

New York, which receives approximately 8.4 percent of Section 105 funds, should get about $7.4 million in FY 1982, the same as in the previous fiscal year.

Background

Section 105(b) states, "no agency shall receive any grant under this section during any fiscal year when its expenditures of non-federal funds for other than non-recurrent expenditures for air pollution control programs will be less than its expenditures were for such programs during the preceding fiscal year . . . (except) . . . that a reduction in expenditures is attributable to a non-selective reduction in expenditures in the programs of all executive branch agencies of the applicable unit of government . . . ."

Thus, any agency currently receiving a federal grant which makes even a one dollar reduction from a previous year's baseline is in jeopardy of losing its total grant. Only in the event of an across-the-board cut for all state agencies would the air pollution agency not lose its grant. Even then, however, it is doubtful that within any state, all agencies wind up taking precisely the same cut. In addition to the problem of cuts, Congress, in the last few years, has not appropriated adequate funds to keep up with the full needs of air pollution agencies. In some instances, some agencies have received substantial cuts in federal funds, with severe impacts on the program, while others have received an increase in funds.

NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

Problem

Sections 108 and 109 of the Clean Air Act require that scientific information about the impacts of air pollution on public health and welfare be published in criteria documents along with control measures available, and that, following publication, the Administrator adopt ambient air quality standards to protect both public health and welfare. Often, the criteria documents are criticized for not using the best scientific information, especially when the Administrator reaches the point of setting the standards.

EPA staff, with the help of contractors, prepare the criteria documents, which are then reviewed by the Clean Air Science Advisory Committee, an independent review committee composed of seven members who are appointed by the Administrator in accordance with Section 109(b)(2)(A). The role ~~of~~ this committee, however, has been limited primarily to the review of the criteria published under Section 108. Even though the committee is established in Section 109 and has some responsibility for recommending standards to the Administrator, EPA's general counsel has determined that the committee's role is primarily limited to criteria documents and that it cannot, in fact, make recommendations on the standards to the Administrator until after he/she has published such standards for public comment.

The health standards often are perceived as being established on the basis of protection of the most sensitive individual, with a factor of safety built in. They do not truly reflect the concept of adverse health effects. The welfare, or secondary standards as they are commonly known, are designed to protect vegetation, visibility or economic damage. Most often, the secondary standard does not take into account the fact that the purpose for which the standard is designed may not be justified on a national basis, since not all parts of the country grow all types of crops or have the same types of material or visibility problem.

Those standards that are designed on a short-term basis usually may be exceeded only once each year; yet, meteorological events or natural occurring pollutant concentration may cause several exceedances during a year and thus produce a violation of the short-term standard. This is particularly true when one uses modeling to determine compliance with the standard rather than actual monitoring data, especially for new source review programs.

Solution

1) Revise the law to require a standard-setting process which would be based on protection against adverse health effects which takes into account public health risks and social and economic impacts.

2) Revise the law to require that the health portion of the criteria documents be prepared by an independent scientific group, such as the National Academy of Science. Further, require that the Administrator receive a recommendation from the Clean Air Science Advisory Committee prior to his/her formal notification of a proposal to adopt the standard. The Committee's role would be to provide scientific guidance to the Administrator on the adverse health effects and the economic and social impacts of possible standards for a particular pollutant.

3) Revise the law so that the Administrator will publish "guideline standards" for secondary air pollutants, again using a scientific committee prior to such publication so that the states may select, from the guidance, secondary standards to protect the particular elements of welfare within each individual state or air quality region, or even a portion of an air quality region.

Rationale

1) The ambient air quality standards are designed to protect public health. Almost invariably, someone doing a scientific study can find some individual who is supersensitive to the particular contaminant being studied. Use of such supersensitive individuals has resulted in EPA staff recommendations to the Administrator that the standard be established at extremely low levels, even though the majority of the population would not be affected. Most often, the supersensitive individual is affected in a minor way - not adversely, as defined in the proposed solution to this problem. It is clear, however, that the decision to opt for one standard instead of another implies a "judgment" as to how many people should be affected, and this is a form of risk assessment. Such judgments should recognize economic cost as well as public health and other types of social costs. Recognition of the economic costs to achieve greater levels of protection may make the standard setting process more rational than the present system, which bars consideration of any cost except public health costs.

2) If the Administrator utilizes an independent group, such as the Clean Air Science Advisory Committee, and follows its recommendation prior to recommending both health and welfare standards, much of the criticism of the standards can probably be averted.

3) It is necessary to provide some mechanism to allow for more than one annual exceedance of short-term standards to account for natural phenomena and rare meteorological events. This is particularly necessary because of the limitations to input data and modeling techniques, which make it unreasonable to expect

models to reliably and consistently predict short-term air quality. The models are being asked to do too much. Predicting the second highest value of a 24-hour concentration during a year at a specific location represents a frequency of occurrence of only about 0.5% and, for a one-hour standard, a frequency of occurrence of only 0.02%. We are trying to stretch models beyond reliable limits in analyzing unrepresentative conditions, such as unusual meteorological events. This placing of unrealistic demands on models causes many areas to be classified as non-attainment, even when actual air sampling data show that the area is meeting ambient air quality standards. Thus, an allowance for more exceedances of the short-term standard would correct this problem.

Most welfare effects, such as impacts on vegetation, water, wildlife, and even visibility, are local. Thus, a nationwide secondary standard may well be inapplicable in most areas of the country. The adoption of locally based secondary standards, which would take into effect the economy of the area, would seem to be a most prudent approach. Provision could be made by Congress to protect national parks and wilderness areas - i.e., those classified as Class I under the PSD requirements - by imposing on those areas appropriate secondary standards if the state fails to take action to protect such areas.

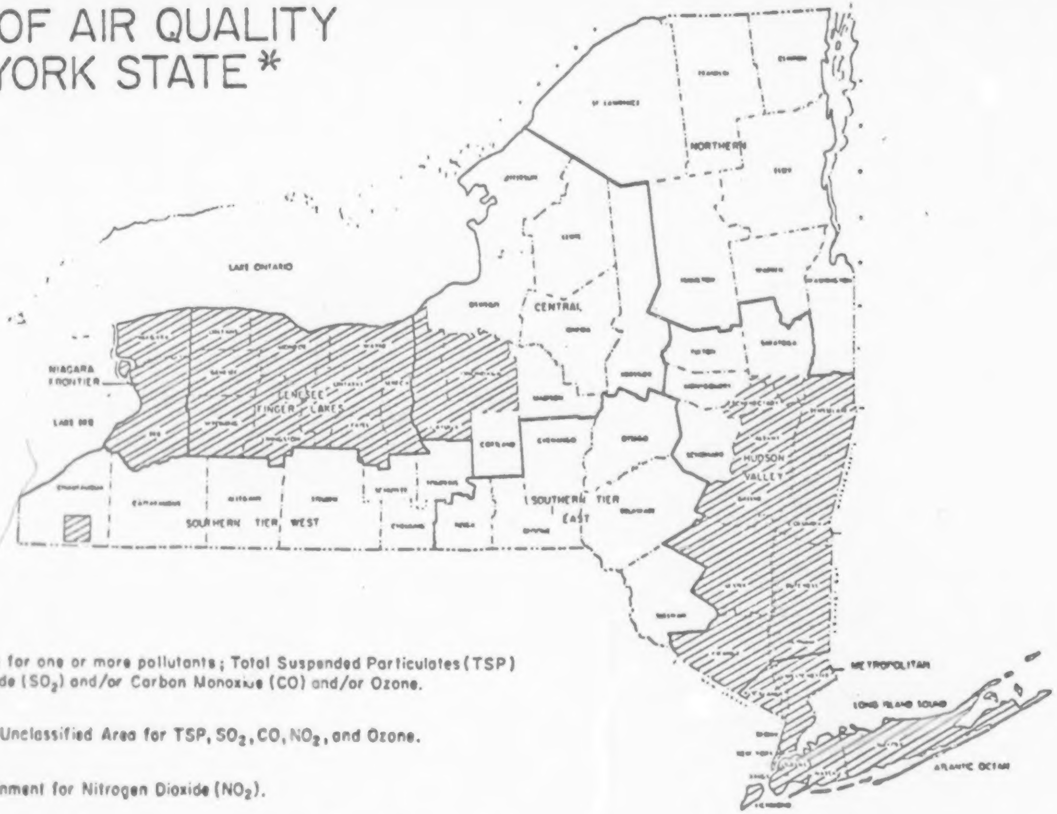
Background

National ambient air quality standards, composed of primary (protecting health) and secondary (protecting welfare) ambient standards, are meant to establish allowable pollution levels for the surrounding air. EPA sets standards for pollutants which it deems to be reasonable hazards. States are required to devise strategies for attaining the standards by 1982, although the deadline can be extended to 1987 for particularly dirty regions under certain circumstances. New York favors such flexibility for ozone, and perhaps carbon monoxide, as long as reasonable progress towards achieving the ambient goal is demonstrated.

So far, EPA has set standards for nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter, carbon monoxide (CO) hydrocarbons (HC), ozone (O_3) and lead (Pb).

All 8 regions are in compliance with the standards for NO_2, SO_2, and Pb. The particulate standard has not yet been met only by part of the Niagara Frontier, which expects to comply by 1982. The New York Metropolitan region is the only one still to comply with the CO standard, and expects to meet it by 1987 (probably sooner). The region has implemented an inspection and maintenance (I&M) program, without which it assumes compliance would not be achieved by that date. In 1981, the I&M program calls for mandatory inspection and voluntary compliance, while both facets become mandatory in 1982. Finally, the standard for ozone has not been met by three regions. These regions, with their expected compliance dates, are: Niagara Frontier (1982); Genesee-Finger Lakes (1982); and New York Metropolitan (1987).

STATUS OF AIR QUALITY IN NEW YORK STATE*


NORTHERN
CENTRAL
LAKE ONTARIO
NIAGARA FRONTIER
LAKE ERIE
GENESEE FINGER LAKES
SOUTHERN TIER WEST
SOUTHERN TIER EAST
HUDSON VALLEY
METROPOLITAN
LONG ISLAND SOUND
ATLANTIC OCEAN

▨ Nonattainment area for one or more pollutants; Total Suspended Particulates (TSP) and/or Sulfur Dioxide (SO_2) and/or Carbon Monoxide (CO) and/or Ozone.

☐ Attainment and/or Unclassified Area for TSP, SO_2, CO, NO_2, and Ozone.

Entire state is attainment for Nitrogen Dioxide (NO_2).

* As compared to the National Ambient Air Quality Standards as officially designated by the Environmental Protection Agency.

IMPLEMENTATION PLANS AND NON-ATTAINMENT PLANNING

Problem

There is considerable uncertainty as to what precisely constitutes the State Implementation Plan (SIP) for any given state at any given time, and what the legal significance of some of the elements of the SIP may be. SIP revisions may have been adopted by states but might not yet have received federal approval. In those instances, EPA says the facility is responsible for the "old" regulations, while the state may have already repealed the old regulation in favor of a new set, thus making a source responsible for following two sets of regulations which may, in some instances, be contradictory. This problem is even further compounded by the amount of time EPA has taken to approve (or disapprove, as the case may be) state SIPs. While the law clearly states that EPA has four months to review and approve, or disapprove, a SIP, EPA has consistently said that there is no time limit for approval (disapproval) of any SIP amendment. In some instances, SIPs remain unapproved for periods of years.

EPA further insists that a SIP be legally enforceable before it can approve it. Its interpretation is that all laws, rules, regulations, must be adopted before the SIP is submitted. This is rather cumbersome if EPA, for any reason, decides that it cannot accept any particular law, rule, regulation and will approve the SIP only if the regulations, etc., are changed. Obviously, the states cannot make changes without going through a lengthy hearing process, thus further delaying the SIP adoption process.

EPA often withholds approval on insignificant details. Because of these delays, new technologies or new guidelines may be adopted by EPA in the interim, and then the states are told they must meet this new guidance before the SIP can be approved. This ex post facto procedure places sources in serious jeopardy if they have moved forward at all toward meeting the state requirements.

The SIP process leaves no room for variances, either permanent or temporary, although a long-term variance could be treated as a SIP revision; however, because of the time involved in obtaining SIP approval, short-term relief is not possible under the federal system. Furthermore, variances from technological standards, such as new source performance standards, are not allowed under any circumstance except for the use of innovative technology systems.

Solution

1) Revise the law to clarify the distinction between the informational and the enforceable elements of a SIP and to limit legal enforceability to measures for which air pollution emission reduction credits are taken. Provide for recognition of broad state laws and other legal requirements without having them unnecessarily become part of the enforceable portion of the SIP, except for those portions of the laws and regulations which apply specifically to the air pollution program.

2) Modify the SIP process to require that EPA participate during the state public comment and review period in a binding way, so that duplicative hearings are eliminated and so that EPA will not second guess the states later in the hearing process following formal submission of the SIP to EPA.

3) Provide that short-term variances of up to twelve months can be granted by the states, if they meet substantive and procedural tests as established in the SIP, without need for further EPA approval.

4) Provide for deadlines on EPA review and approval action so that failure by EPA to act constitutes approval on a major SIP if action has not taken place in four months, and on any substantive SIP revision within 60 days. Further, allow states to make minor revisions to the SIP after notification to EPA without need for further EPA approval - i.e., permit conditions, variances, etc.

5) Provide that all operating permit conditions adopted pursuant to rules and procedures contained in the SIP are federally enforceable and thereby eliminate the need for individual site-specific SIP revisions for such permit conditions. This includes the "bubble."

6) Eliminate specific requirements under Section 108(f) related to motor vehicle and transit type pollution problems. Remove the requirement of Section 110(c)(5)(B)(i) related to basic transportation needs or define the term "basic transportation needs" more precisely as it relates to air pollution. Also, change Section 172 so as not to require the burden of meeting the measure contained in Section 108(f). Further, change 176 to protect the states against imposition of sanctions by EPA for EPA's failure to act on any SIP revision in a timely manner.

Rationale

1) Only those SIP requirements which specifically lead to an emissions reduction or prevent an emissions increase in the case of a maintenance plan should be enforceable by EPA. Such items in SIPs as studies or research should not be considered enforceable. Where staff or funding commitments are made, these should not be considered as enforceable items but, rather, as information items.

Often, a SIP requirement is inclusion of procedural elements which are contained in state laws and regulations having broad application. Those elements, which apparently should be enforced by EPA or under the citizen suits Section 304, should only be those portions of broad agency for which the SIP is adopted.

2) The current practice by EPA of not publishing proposed adoption of the state SIP until after the SIP has been submitted and reviewed leads to many abuses and often change because of the time delays in EPA's action. Duplicative review process would be eliminated under the solution given above, and EPA would be bound to the comments which it made in the state's hearing process. The complete record produced by the state would be made available to EPA, and it could follow the state submission with final rulemaking in a very rapid manner. This would still leave opportunity for public comment on the state proposal during the hearing process and, by having EPA testify first and preferably submitting its testimony in writing in advance of the hearing, allow for public comment on the EPA proposals, as well as on the state proposals.

3) Often, short-term variances are needed to correct the problem at a facility or source. These can be caused by breakdown or unanticipated changes - i.e., extreme cost of fuel or lack of availability of fuel during emergencies, or even water shortages such as are currently occurring in northern New Jersey and southeastern New York. Such variances should be grantable by the states on a short-term - not to exceed one year - basis; this without the need for EPA approval. Where longer term variances are necessary, or where administrative orders to correct a problem extend beyond one year, then such variances would become minor SIP revisions subject to the appropriate SIP process.

4) EPA currently takes excessive time to review and approve SIP actions. By establishing a firm deadline for EPA action, with a provision for automatic approval because of failure by EPA to act, the states will not be put in the embarrassing position of having a SIP in a state of suspended animation for months, and even years.

5) Many states have operating certificate programs, and inclusion of conditions on these permits, or certificates, provides the state with immediate administrative control. By making such conditions "federally enforceable" without going through a SIP revision process in each case, the whole air pollution control program would be speeded up and much administrative red tape eliminated.

6) The list of Reasonably Available Control Measures (RACM) in Section 108 and the requirement that they be applied in accordance with Section 172, along with the requirement for EPA to review basic transportation needs, go beyond the requirements of the Clean Air Act. Most of the RACM constitute socially desirable actions but have little, if any, impact on air quality, and in some instances, may actually negatively impact air quality. Listing these in the law, and then requiring that they be implemented, places an undue burden upon the state, which should be free to select any mix of strategies that it feels appropriate to meet the air quality standards.

Finally, the imposition of sanctions for failure to meet SIP requirements, or to have an approved SIP, is a strong tool to help force the reluctant states to move forward. However, this same tool is used indiscriminately against states which are proceeding in good faith and may be held up by EPA's lack of action on a SIP revision. Thus, the imposition of a requirement in 176 that sanctions would not apply if EPA did not act in a timely manner on a SIP would help alleviate this problem. Obviously, this provision would not be needed if EPA had a limited time to act on a SIP and if the SIP were approved upon EPA's failure to act within that time limit.

Background

The SIP is the blueprint used by a state for attaining and maintaining clean air. SIPs detail strategies to meet national ambient standards in non-attainment areas, as well as ensure "prevention of significant deterioration" in clean air areas. In doing so, a plan applies to virtually every source of air pollution within a state's borders.

Every SIP must contain, among other provisions:

-- a plan for every air quality control region not meeting primary standards, which will enable the area to meet them "as expeditiously as possible," but not later than December 31, 1982, except where extensions for transportation pollutants have been given. The plans must provide for progress toward clean air each year until standards are attained;

-- emission limits, or schedules for establishing them, requiring BACT for new sources in "clean" areas, and RACT for existing sources in non-attainment areas; and

-- a permit program for major industry and other "stationary" sources of pollution. In developing a plan, a state tallies emissions for each source in an area and develops control requirements for attainment and maintenance of standards. If necessary to meet these standards, the state can require sources to install controls that go beyond the basic requirements in state and federal law.

The state generally can determine how it plans to have an air quality control region attain the primary standard; however, as has been noted, the SIP, and every revision, has to be approved by EPA, which on occasions might approve a plan conditionally.

EPA is presently empowered to invoke sanctions against states with unapproved SIPs, including moratoriums on permits for new sources and withholding of federal grants.

FEDERAL vs. STATE ENFORCEMENT

Problem

The Clean Air Act continually provides that the states are responsible for carrying out the air pollution control programs; yet, Section 113 has been interpreted by EPA as giving the federal government primary enforcement responsibility. EPA has initiated enforcement action against sources within a state without notification to the state in advance, or, in some instances, with notification to the state but eliminating any role for state action.

Solution

Amend the Clean Air Act to allow for federal enforcement only after adequate notice - i.e., 60 days to the state and after failure of the state to initiate and actively pursue remedial action within the 60-day time period.

Rationale

The state is much more aware of the compliance/non-compliance status of sources within the state and, in those few instances where a source is temporarily out of compliance, EPA should not jump in and start an enforcement proceeding on its own but, rather, should notify the state. The state, in turn, would take appropriate action and start an enforcement program. If for some reason, the state failed to take such action, or needed EPA support, then--and only then--should EPA take legal action. Furthermore, the Section 120 non-compliance penalty program should be incorporated within Section 113 on federal enforcement and, again, state action under Section 120 should be allowed prior to EPA action.

Background

Enforcement measures are to be taken first by local and state authorities. EPA is to step in when asked for technical assistance, when state actions are deemed ineffective or when citizens have filed lawsuits alleging non-compliance with the Act.

The 1977 amendments set up two means of enforcement: civil fines, and administrative non-compliance penalties. A local enforcement official would serve a notice, with a deadline, to a non-complying source; failure to meet the deadline can result in a small fine, with EPA eventually stepping in. In this event, a federal court could levy a civil penalty of $25,000 per day per source on first-time violaters. Repeat violators can be fined $50,000 for each day a source is out of compliance.

INTERSTATE AIR POLLUTION, LONG RANGE TRANSPORT, AND ACID PRECIPITATION

Problem

Acid rain and other long range transported pollutants are beyond the control of the individual states through the SIP process, and EPA has not (and probably cannot) effectively address these problems through Section 126. In general, utility power plants with tall stacks burning high sulfur fuels are responsible for a significant portion of the problem. Many of these sources are located in the Midwest. At the same time, most of the eastern states have adopted very restrictive sulfur limits - especially in the more populated areas. Ozone is primarily caused by volatile organic compound (VOC) emissions throughout the area, which, along with ozone, are sometimes transported hundreds of miles as they react to form ozone.

Solution

1) Amend the Clean Air Act to require that all coal above three percent sulfur burned by utilities be washed (or cleaned) so as to reduce sulfur - unless such cleaning can be shown to have no effect on sulfur content of the coal. Further, require that all coal-fired utility boilers retrofit burners to reduce nitrogen oxide emissions.

2) Accelerate research toward determination of causes and effects of acid precipitation.

3) Require that all sources of VOC over 100T/yr actual emissions be required to use reasonably available control technology so as to reduce emissions.

Rationale

1) Most of the eastern United States is currently using lower sulfur fuel than the Midwest. Some oil-fired power plants will be required to convert to coal. By requiring a simple control expedient, such as coal washing, about three million tons of sulfur dioxide would be removed if the lower cut point were three percent sulfur coal.

   Where applicable, and if the systems have been fully developed, retrofit of coal-fired utilities to staged combustion would help reduce oxides of nitrogen, another component of acid rain and a component in atmospheric ozone production. While both of these are modest efforts, both in terms of reduction and cost, they are positive steps which should be taken while more research on the causes and effects of acid rain are undertaken.

2) All of the evidence on the formation, long range transport and effects of acid deposition is not yet in. Research to determine the implications of acid precipitation should be accelerated since there is every indication that the problem may be global

in nature. Research, however, should not be used as an excuse for doing nothing; therefore, some modest control measures, as mentioned above, should also be initiated.

3) Currently, VOC sources in attainment and unclassified areas are not required to have controls, regardless of size of source. As a first step, imposition of controls on all. 100T/yr or greater VOC sources will help reduce the transport problem and may make it practicable for most major metropolitan areas to meet the ozone standard with the reasonable control measures contained in current SIPs.

Background

As amended in 1977, the Clean Air Act says a state may not pollute in such a manner that will prevent attainment of primary ambient (health) standards in another state; however, EPA has not provided a regulatory framework to ensure this.

The New York State Department of Environmental/Conservation recently conducted a study of the effects of acid precipitation, and found that, as of August, 1980, almost 10 percent of the lakes and ponds in the Adirondacks region were in a critical state of acidification (pH below 5). Further, an additional nine percent are in an endangered situation (pH between 5 and 6). The State clearly believes that enough information is now known on the effects of acid precipitation to warrant instituting measures to reduce it. In this case, failure to act would be more costly than instituting measures to reduce the problem.

PREVENTION OF SIGNIFICANT DETERIORATION

Problem

Prevention of Significant Deterioration (PSD) requirements have become a formidable deterrent to new construction and to coal conversion. The regulations and administration are cumbersome, confusing, restrictive and overly expensive to meet. Time delays in obtaining approval for new facilities have been excessive. The concept of protecting pristine areas and national parks is laudable, but excesses in the name of such protection have created the problems mentioned above.

Solution

1) Amend the CAA to eliminate the incremental limits for air quality degradation in Class II and III areas, while adopting the requirement for Best Available Control Technology (BACT) on all new sources (or major modifications) 50T/yr or greater actual emissions.

2) Eliminate short-term increments for Class I areas and modify the threshold for applicability to 100T/yr actual emissions, regardless of whether new construction or modification.

3) Retain the current requirement that NAAQS cannot be violated, but eliminate pre-application monitoring and modeling except as necessary in obviously borderline cases to demonstrate that NAAQS (or Class I increments where applicable) will not be violated.

4) Limit PSD requirements only to NAAQS pollutants.

Rationale

1) The controlling factor in preventing deterioration in most Class II and III areas is usually the requirement for BACT. By eliminating Class II and III increments and requiring that all new sources be reviewed only for BACT applicability, we would be remova series of procedural steps which usually tend to delay projects. Furthermore, we would be requiring substantially the same review regardless of the location of the source - attainment areas or non-attainment areas. Sources outside of, but impacting upon, a Class I area must still meet increment requirements for such an area.

2) The areas that need protection from development and significant deterioration are unique and pristine areas. Congress has already designated those areas requiring protection as Class I. The short-term increment requirement, however, creates problems for location of facilities in such areas, or even near such areas, because of unusual and rare meteorological phenomena which must be used in modeling for short-term impacts. Furthermore, short-term impacts are transient and, therefore, not "significant deterioration." Some people argue that short-term increments help protect visibility, but if that is a problem, then adoption of a visibility standard is probably a more logical solution.

3) Pre-application monitoring and modeling are expensive and time-consuming. In most attainment areas, they are unnecessary, since the areas are usually much cleaner than the NAAQS.

4) PSD review should only be limited to NAAQS pollutants since it is inappropriate for other NSPS and NESHAPS pollutants. Furthermore, PSD Class I increments would have to be developed for every pollutant if PSD review were required, and ambient monitoring techniques established. In most cases, the non-NAAQS pollutants are emitted in small amounts on a regional or small area basis - not nationwide. To impose the same requirements for such sources will lead to excessive delays in review while decisions are made about the type of sampling to use and the acceptable ambient increments.

Background

Congress mandated PSD for areas with air cleaner than ambient standards. PSD areas are classified into one of three categories for the purpose of deciding how much deterioration should be allowed. Air which is presently better than the NAAQS is not permitted to get "significantly" dirtier. The three categories, each allowing a different amount of pollution increases, or "increments," are:

Class I--most national parks and wildernesses; very little pollution increases allowed;

Class II--all other areas are now in Class II; increment is sufficient to allow for moderate growth; and

Class III--no Class III areas yet exist; increment allows for greater pollution increases.

The increments allowed go on top of existing, or "baseline," pollution levels. An increment is not a total allowable amount of pollutant concentration, but an amount over a given baseline. The 1977 amendments applied the increment system to two of the pollutants subject to primary standards--sulfur dioxide and particulates. EPA is supposed to set increments for the other pollutants.

Presently, owners of proposed facilities large enough to affect air quality must prove through modeling and monitoring that their facilities will meet PSD requirements. PSD requires "best available control technology" (BACT) of every major new source and major modifications that will emit "significant" amounts of pollution. This technology, determined on a case-by-case basis, may not be less stringent than new source performance standards. Costs must be considered in setting BACT.

NEW SOURCES, BUBBLE AND COAL CONVERSIONS

Problem

New source performance standards (NSPS) are often counter-productive when an existing source modernizes. They require the new source or modification to meet NSPS, but old sources continue to emit pollutants beyond reasonable technology. There is also concern that coal conversions, unless done under an energy act order, will be treated as new sources--thus interfering unduly with energy independence, while not appreciably impacting on air quality.

Solution

1) Revise the Act to permit sources within an AQCR, or in the adjoining AQCR's, to trade emissions between the sources to comply with the emission requirements of a SIP, even if a "new" source. Under this tradeoff (offset) policy, the emissions from some sources would be allowed to increase when accompanied with equal or greater compensating decreased emissions from some other sources located within the same AQCR, or adjoining AQCR, provided the ambient air quality standards are maintained.

2) Revise the Act to allow that any boiler originally designed for coal may convert back to coal as long as it meets appropriate state emission standards and will not cause a contravention of ambient standards. Such sources would not be required to meet NSPS.

Rationale

1) The current bubble policy does not apply to new sources, even though they may be located next to or near existing sources. Because of the high cost of lower sulfur oil, there is an incentive for certain utilities to operate less efficient older sources which can often burn higher sulfur oil rather than run a more efficient new source which, because of new source performance standards, must burn lower sulfur but most costly oil. Also, some sources burning low sulfur oil are unable to convert to coal because of the stringent sulfur emission limitations. If all sources within the same ACQR and in the adjoining AQCR's are permitted to trade emissions, utilities could select fuels with sulfur content that would result in the same, or fewer, total emissions from all units. The bubble policy could even require a net reduction in emissions in the AQCR. As a result, costs for utility ratepayers would be lower and air quality would be improved in the AQCR. In some cases, the bubble policy will make possible the conversion of some oil burning plants to coal which otherwise may not be able to convert. The same logic applies to other types of sources.

2) Boilers which were originally designed for coal should be allowed to convert, whether voluntarily or under an energy order. However, NSPS has been interpreted by some people as being applicable to voluntary conversions. To overcome this interpretation, the statutory provision for NSPS should contain a clear exemption for sources which previously burned coal. It is counterproductive to good energy management to force "scrubbers" on these conversions, especially since this cost would probably be so excessive, in some cases, as to prevent the conversion back to coal. This is especially true where such a degree of control is not necessary to meet or maintain air quality standards.

Background

The Clean Air Act calls for minimum federal emissions performance standards for new sources of pollution for a variety of reasons, including preventing states from competing with one another for new industry by relaxing pollution controls. Thus, Congress established NSPS, covering both new plants and major modifications for major polluting industries on an industry-by-industry basis. (See definitions of BACT, LAER, NSPS and RACT.)

AUTOMOTIVE POLLUTANTS

Problem

Strictness of automotive emission standards is the primary issue. Any relaxation of federal automotive emission standards places a potentially greater burden upon the states to regulate stationary sources beyond reasonably available control technology (RACT).

Solution

If Congress gives any extension to the auto industry to meet vehicle emission requirements, then a comparable extension should be given to the states to come into compliance with appropriate ambient air quality standards.

Rationale

Most stationary sources of VOC in non-attainment areas are either under control or are about to come under control in accordance with SIP requirements. If Congress extends the time for motor vehicles to meet VOC and NOx requirements, then the states must be given a comparable extension to meet air quality standards.

Background

The 1970 Clean Air Act called for a 90 percent reduction in the pollution coming out of auto tailpipes by the mid-1970's. This goal applies to the three main auto pollutants: carbon monoxide (CO), hydrocarbons (HC) and nitrogen oxides (NOx). Though delayed in 1974 and again in the 1977 amendments for fuel economy and other reasons, the 90 percent reduction has been met for CO and HC. The NOx reduction was relaxed in 1977 to 75 percent, and was met in 1981 model year vehicles.

The limits for auto pollutants are set in grams per mile. The auto industry wants to relax the carbon monoxide limit, from 3.4 grams per mile to 7 grams per mile, contending that public health risks would not be created, while the financially troubled industry achieves great savings. New York has stated that relaxing the auto emission standards without permitting a state additional time in which to meet air quality standards will increase pressure to control industrial growth in order to achieve clean air standards.

DEFINITIONS AND GLOSSARY

- Best Available Control Technology (BACT): requirements are set by states on a case-by-case basis, and are required for all major new or expanding pollution sources in "clean air" regions. Costs must be considered in setting BACT, which may not be less stringent than new source performance standards.

- "Bubbling": a policy in which an imaginary bubble is drawn around an entire plant or region; the company or region must find the most efficient way of controlling the plant's/region's emissions as a whole. As long as no more emissions escape from the overall bubble than before, innovation can continue.

- Increment: a graduated scale of allowed pollution increase for each class (Class I, II, and III--see Prevention of Significant Deterioration). It is not a total allowable amount of pollution concentration, but an amount over a given baseline. This provides for some industrial growth in areas with air cleaner than the national ambient standards.

- Inspection and Maintenance (I & M): a program which calls for annual inspections of automobiles in order to check for excess emissions. When excess emissions are found, the owner must have the vehicle repaired. States which seek compliance extensions for automotive pollutants, such as carbon monoxide and ozone, must utilize measures which will ensure compliance by the extended date; I & M is an example of such measures.

- Lowest Achievable Emission Rate (LAER): requirements are set by states on a case-by-case basis, and are required for major new or expanding sources in areas which do not meet federal ambient air standards. LAER, which is set without regard to cost, is defined as either the most stringent emission limitation contained in the implementation plan of any state for a category of sources, or the most stringent emission limitation demonstrated within an industrial category.

- Modeling: scientific computer technique used to project increased emissions from new sources of air pollution and their impact on ambient air quality and compliance with ambient health standards.

- Monitoring: actual ambient air quality at representative sites is sampled to determine pollution levels and compliance with standards.

- National Ambient Air Quality Standards (NAAQS): are composed of primary (protecting health) and secondary (protecting welfare) ambient standards, which are meant to establish allowable pollution levels for the surrounding air. The deadline for states to meet primary standards is 1982, although states can receive extensions to 1982 in areas where automobile-related pollution is severe. There are no deadlines for secondary standards.

- New Source Performance Standards (NSPS): are set by the Environmental Protection Agency for industrial categories, forming the minimum for major new or expanding pollution sources. Costs must be considered in seting NSPS.

- **Non-Attainment**: regions with air pollution which violates primary standards are designated as "non-attainment." Most of the 247 air quality control regions in the Untied States are non-attainment areas for one or more of the primary pollutants. These dirty air regions are subject to strict controls to bring them into compliance with the health standards.

- **Offsets**: a new source in dirty air regions must ensure that an existing source reduces its emissions by at least the same amount as the emissions to be yielded by the new source.

- **Prevention of Significant Deterioration (PSD)**: mandated by Congress for areas with air cleaner than ambient standards, PSD areas are classified into one of three categories for the purpose of deciding how much deterioration should be allowed.

Class I:	most national parks and wildernesses; very little pollution increase allowed;
Class II:	all other areas are now so classified; increment is sufficient to allow for moderate growth;
Class III:	no such areas yet exist; increment allows for greater pollution increases.

- **Reasonably Available Control Technology (RACT)**: requirements are set by states on a case-by-case basis, and are required for many existing polluters in areas which do not meet federal ambient air standards. Costs must be considered in setting RACT.

- **State Implementation Plans (SIPs)**: plans developed by states to spell out the detailed strategies for meeting the primary standards. SIPs are subject to approval by the Environmental Protection Agency.

- **Types of Pollutants**: The Environmental Protection Agency has established primary and secondary standards for seven pollutants:

1) carbon monoxide (CO): automobiles are the main source of CO, a colorless, odorless gas which can cause dizziness, unconsciousness, and death in extreme concentrations by depriving the blood of oxygen. Its concentration is greatest where there is heavy traffic in confined areas. Areas with extreme auto pollution can get extensions until 1987 to meet the CO standards.

2) hydrocarbons (HC): these pollutants are the product of incomplete gasoline combustion and fuel evaporation, and come from both automobiles and industry. HCs react with nitrogen oxides to form smog. Scientific studies show that some HCs are toxic but most are not.

3) lead (Pb): emissions come primarily from anti-knock agents in gasoline, as well as from the lead industry. Lead pollution can affect the kidneys, and the nervous and blood-forming systems, and may cause learning disabilities in young children, according to EPA.

4) nitrogen dioxide (NO_2): this pollutant is a byproduct of industrial processes. Some 40 percent of all NO_2 comes from automobile emissions. According to EPA, nitrogen oxides can lower body resistance to some respiratory infections and can increase lung disease. NO_2 contributes to ozone formation, and is most prevalent in industrial regions, plus wherever there is heavy traffic.

5) ozone (O_3): formed in sunlight when nitrogen dioxide reacts with hydrocarbons and other chemicals in the air to create smog. Ozone primarily causes respiratory problems, according to EPA, ranging from coughing to impairment of lung function. It can also increase susceptibility to heart disease. Areas with extreme auto pollution can get extensions to 1987 to meet primary standards for ozone, when they agree to undertake strict measures to clean up ozone pollution. Ozone pollution is caused by both stationary sources and automobiles.

6) sulfur dioxide (SO_2): a corrosive gas emitted during coal and oil combustion and other industrial processes. SO_2 has the unpleasant odor of rotten eggs and is associated with colds and aggravation of asthma and bronchitis, according to EPA. The major emitters are fuel-burning industries, utilities, and heating capacity. In addition to damage to the respiratory system, lung and heart conditions can result. SO_2, which can corrode iron and steel, combines with other pollutants in the atmosphere and can return to the earth as acid precipitation. It also contributes to visibility problems. SO_2 levels are highest in highly industrialized regions of the country, like the Northeast. But these emissions are also present wherever industry exists, including rural areas.

7) total suspended particulates (TSP): these are basically dust and liquid particles from industrial plants, heating boilers, automobiles, and roads. Large particulates can clog the lung sacs, says EPA. The smaller particles can carry other toxic substances into the deep lung and bloodstream. TSP can also create visibility problems. Particulate problems are more acute in industrialized regions.

ONTARIO MINISTRY OF THE ENVIRONMENT

DR. GREGG VAN VOLKENBURGH
DIRECTOR
AIR RESOURCES BRANCH

REMARKS ON:

TRANSBOUNDARY AIR POLLUTION

TO:

THE UNITED STATES SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

ALBANY, NEW YORK

WEDNESDAY, JULY 1, 1981

GOOD MORNING! MY NAME IS GREGG VAN VOLKENBURGH AND SINCE MY REMARKS ARE BRIEF AND THEREFORE NECESSARILY ILLUSTRATIVE, I WILL BE REFERENCING SOME RECENT WORK IN THE FIELD AS I PROCEED.

I WOULD LIKE TO BEGIN WITH EMISSIONS OF SO_2, AND REFER TO TWO TABLES WHICH ARE PART OF THE ADDENDUM TO MY REMARKS.

ONE SHOWS HOW ONTARIO'S CONTROL PROGRAMS ARE REDUCING AND WILL CONTINUE TO REDUCE OUR SO_2 EMISSIONS. ACTUALLY, THE 1990 FIGURES WILL BE SIGNIFICANTLY LOWER BECAUSE OF ADDITIONAL CONTROL MEASURES PLACED ON INCO PRIOR TO 1985. THE NEXT TABLE SHOWS EMISSIONS IN THE EASTERN UNITED STATES. WITH THE EXCEPTION OF REGIONS I AND II, THERE IS LITTLE DOWNWARD TRENDS (SEE REF. 1) AND IN THE YEARS AHEAD THERE MAY EVEN BE INCREASES IN AREAS SUCH AS REGION 5, WHERE POWER PLANT RETIREMENT SCHEDULES MAY BE STRETCHED OUT (SEE REF. 2) AND SIP'S MAY BE RELAXED FURTHER. AS SCIENTISTS IN CANADA, WE ARE CONCERNED TO SEE OUR REDUCTIONS GO UNMATCHED AND, IN FACT, POSSIBLY BE NEGATED BY INCREASES IN THE U.S.

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Present levels of emissions in this part of the world quite definitely dominate nature (see Ref. 3) and therefore should be expected to affect our environment. Weather and atmospheric chemistry can accelerate and enhance these effects. In the next slide, I would like to show you that although chemistry and weather are complex topics, it is possible to draw some conclusions, namely:

1. That there are many different mechanisms to transform sulphur dioxide into acid or neutral sulphates
2. These mechanisms operate alone or in combination at different times in different places
3. While we do not know everything about all the mechanisms, there is much observational data that confirms the fact that SO_2 does routinely get transformed into acids and neutral sulphates and that on a longer term basis it is possible to approximate this process with confidence.
4. The same can be said for nitrogen compounds (see Ref. 4)

The next slide illustrates that the phenomenon of deposition, though complex, lends itself to reasonable approximation as well. Wet and dry processes occur on a local as well as a long range basis in a variety of ways.

One of the problems in dealing with long range transport is that episodes may occur, with accompanying damage. But the damage to ECO systems may also be based on longer time scales which can be approximated by averaged behaviour. Very graphic evidence of episodes is well documented in Ontario and the north-east by means of satellite and meteorological "back trajectories" (see Refs. 5 and 6), and this evidence illustrates conclusively that long range transport does not respect international or state boundaries. As an example, I would like to quickly point out three subsequent days in 1979. On all three days the air crossed the States and countries, and on the day when very high SO_2 and particulate levels occurred in New York, Pennsylvania and Ontario, the air mass history had a clear association with areas of relatively high emissions in other States. Other back trajectory work which Ontario scientists have performed using monitoring sites in remote parts of Ontario show that event after event brings significant amounts of SO_2 sulphates, ozone, or acid rain into areas where there are no local emissions to complicate the analysis (see Ref. 7).

Since long range transport occurs, how can one assess the longer term damage from areas containing several emitters? In Ontario we have developed an internationally respected long range transport model to use as a guideline.

ITS RESULTS, WHEN PROVEN OUT BY FIELD DATA, ARE EMPLOYED ON AN EXTENDED BASIS TO GAIN AN UNDERSTANDING OF WHAT SOURCES ARE CAUSING ACID RAIN. (SEE REFS. 8 AND 9).

WE HAVE USED THIS MODEL AS AN IMPORTANT ELEMENT OF DECISION MAKING (SEE REF. 10) IN CONTROLLING EMISSIONS OF SO_2 AND NO_x TO REDUCE LOADINGS IN SENSITIVE AREAS OF NEW YORK AS WELL AS ONTARIO. WE HAVE ALSO USED THE MODEL AS A GUIDELINE TO PREDICT WHAT WILL HAPPEN IF THE SOURCES DISCUSSED IN EPA'S RECENT SECTION 126 HEARINGS HAVE THEIR EMISSIONS CEILINGS RAISED, AND EMIT AT THOSE NEW LEVELS.

I WOULD LIKE TO SHOW YOU TWO KINDS OF RESULTS. THE FIRST SLIDE SHOWS THAT IN ONTARIO, NEW YORK, AND PENNSYLVANIA THERE IS A SIGNIFICANT INCREASE IN PREDICTED WET DEPOSITION OF SULPHUR DUE TO RELAXATIONS OF 20 SOURCES CITED BY NEW YORK. THE NEXT SLIDE SHOWS THE RELATIVE EFFECTS OF THE 53 SOURCES CITED BY NEW YORK AND PENNSYLVANIA COMPARED TO OTHER SOURCES. THE CHANGES IN DEPOSITION AND CONCENTRATION DUE TO THESE RELAXATIONS IS OF GRAVE CONCERN TO US BECAUSE THE WET DEPOSITION OF SULPHUR IS HIGHLY CORRELATED WITH ACIDITY. THESE INCREASES ILLUSTRATE THE DEGRADATION OF THE NORTH-EAST'S ENVIRONMENT WHICH WILL LIKELY OCCUR OVER THE LONG TERM IF EFFECTIVE LEGISLATIVE MEASURES ARE NOT PUT IN PLACE TO STOP THE EMISSIONS INCREASES AND, IN FACT, REDUCE THEM.

IN ONTARIO WE HAVE BEEN CONTROLLING SULPHUR AND NITROGEN POLLUTION BUT THERE ARE OTHER FORMS OF POLLUTION SUCH AS OZONE OVER WHICH WE HAVE VIRTUALLY NO CONTROL. EVERY SUMMER ABOUT 20% OF THE TIME, OUR OZONE AIR CRITERION IS EXCEEDED. THIS CAUSES DAMAGE TO OUR CROPS AND PROPERTY. THE SAME PHENOMENON OCCURS IN THE U.S. AND IT IS ESTIMATED (SEE REFS. 11 AND 12) THAT ON A YEARLY BASIS ABOUT $1.8 BILLION AGRICULTURAL DAMAGE AND ABOUT $2.5 BILLION PROPERTY DAMAGE (AS EXPRESSED IN SLATED 1970 DOLLARS) OCCURS NATIONALLY. IT IS LIKELY THAT THE MAJORITY OF THIS DAMAGE IS IN THE EAST, WHERE AGRICULTURE, POPULATION AND OZONE LEVELS ARE MOST INTENSE. IT IS LIKELY THAT THESE FIGURES ARE ALSO UNDER-ESTIMATES OF ACTUAL DAMAGE.

I HOPE IT HAS BECOME CLEAR TO YOU THAT AS CANADIANS:

A) WE ALREADY SUFFER DAMAGE DUE TO LONG RANGE TRANSPORT AND WE WILL SUFFER MORE IF NOTHING IS DONE

B) WE HAVE AMASSED, AND ARE CONTINUING TO AMASS, EVIDENCE THAT LONG RANGE TRANSPORT IS A REALITY

C) WE HAVE SHOWN THAT IT IS INTERNATIONAL IN NATURE

D) WE HAVE DEVELOPED TECHNIQUES TO REASONABLY ESTIMATE THE CAUSE AND THE EFFECT RELATIONSHIPS

E) WE HAVE USED THESE DATA TO BEGIN AN INTERNATIONAL SOLUTION

BY REDUCING EMISSIONS BASED ON THE PROTECTION NOT ONLY OF HUMAN HEALTH, BUT OF THE ENVIRONMENT AS A WHOLE.

I THINK YOU CAN SEE THAT WE ARE CONCERNED ABOUT THE U.S. EMISSION TRENDS AND THE ABILITY OF THE REGULATORY FRAMEWORK TO REDUCE BOTH EMISSIONS CAUSING INTERSTATE AND INTERNATIONAL TRANSPORT AND DAMAGE. IN THE FACE OF MOUNTING EVIDENCE FROM EUROPE, THE U.S., AND CANADA, ONTARIO HAS CONCLUDED THAT AT THE VERY LEAST, EMISSIONS SHOULD BE FROZEN UNTIL MORE DETAILS ARE KNOWN. IN THE CASE OF LARGER SOURCES WHOSE EMISSIONS WILL TAKE A LONGER TIME TO REDUCE, INTERIM CONTROL ACTION CAN BE STARTED NOW, WHILE RESEARCH CONTINUES. THANK YOU.

ADDENDUM: PRESENTATION BY DR. GREGG VAN VOLKENBURGH

TABLE 1

TRENDS & PROJECTIONS OF SULPHUR DIOXIDE EMISSIONS IN ONTARIO (IN METRIC TONS)

YEAR	SO_2 EMISSIONS	NOTES
1972	2,870,000	
1973	2,220,000	
1974	2,300,000	
1975	2,230,000	
1976	2,070,000	
1977	2,210,000	
1978*	1,557,000	INCO Strike Year
1979*	1,325,000	INCO Strike Year
1980	1,690,000	
1982	1,673,000	Assume INCO is at 1,950 tons/day or 646,000 Tonnes/year and assume Ontario Hydro is at 582,000 Tonnes (peak)
1985	1,480,000	Assume Ontario Hydro is at 390,000 Tonnes and assume INCO is at 646,000 Tonnes
1990	1,350,000	Assume Ontario Hydro is at 260,000 Tonnes and assume INCO is at 646,000 Tonnes

June 1981
Ontario Ministry of the Environment
Air Resources Branch

TABLE 2

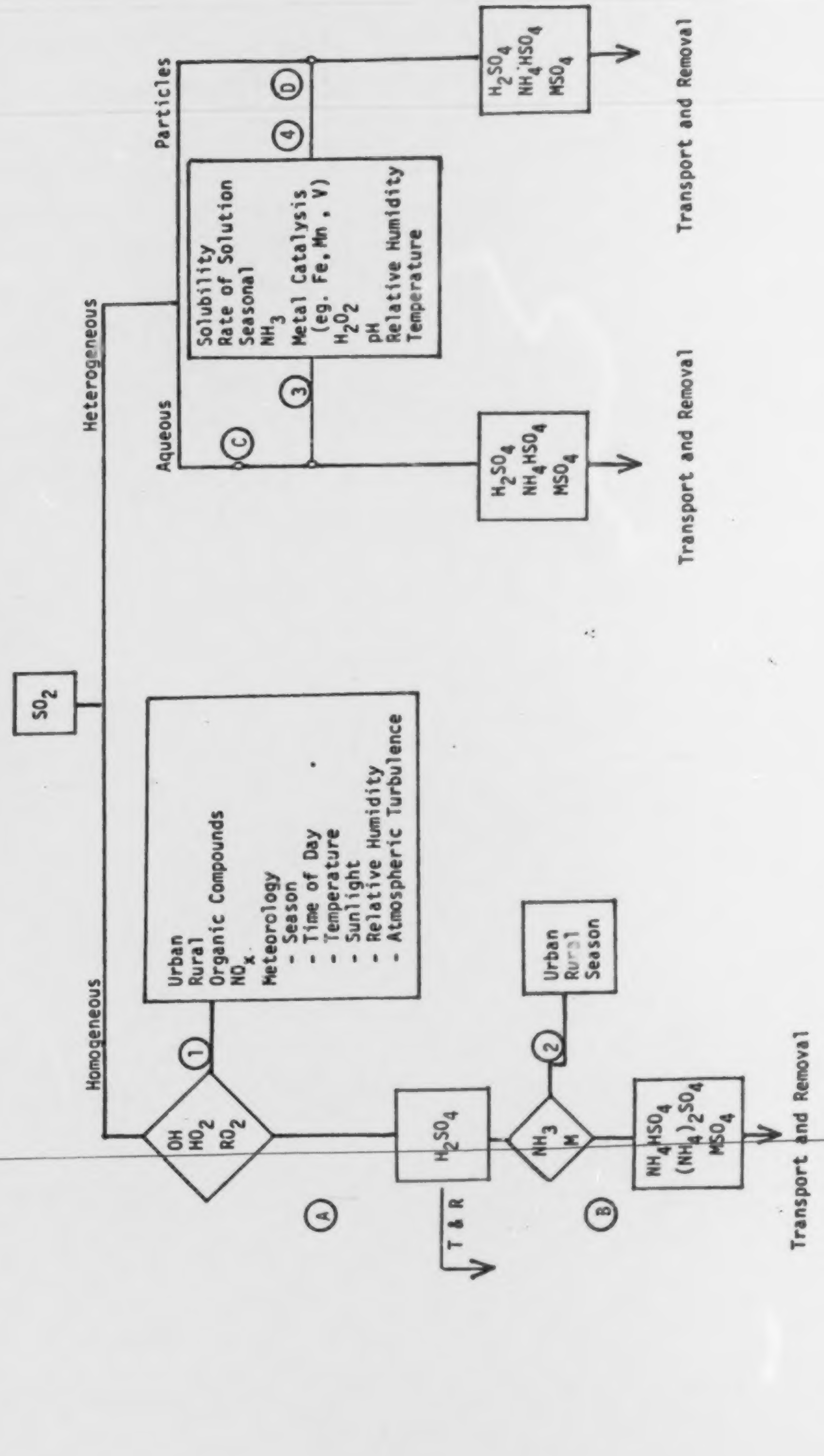
U.S. TRENDS IN SO_2 EMISSIONS (IN METRIC TONS)*

AREA	1965	1970	1975	1978
EPA-REGION 1 (Conn, Maine, Mass. New Hamp. Rhode Is.	980,000	1,033,000	654,000	606,000
EPA-REGION 2 (New York, New Jersey)	2,058,000	1,855,000	1,288,000	1,238,000
EPA-REGION 3 (Delaware, D.C., Maryland, Penn. Virginia, W.Va.)	3,960,000	4,055,000	3,878,000	3,513,000
EPA-REGION 4 (Alabama, Florida Georgia, Mississippi, Kentucky, N.Carolina S. Carolina, Tennessee)	3,486,000	4,825,000	5,344,000	5,228,000
EPA-REGION 5 (Illinois, Indiana, Mich., Minn., Ohio, Wisc.)	9,796,000	8,951,000	8,347,000	8,048,000
TOTALS	20,280,000	20,719,000	19,511,000	18,633,000

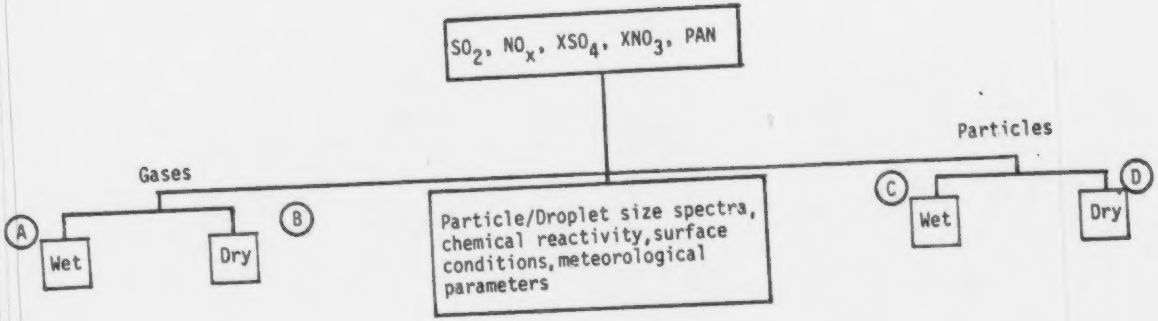
*REFERENCE:

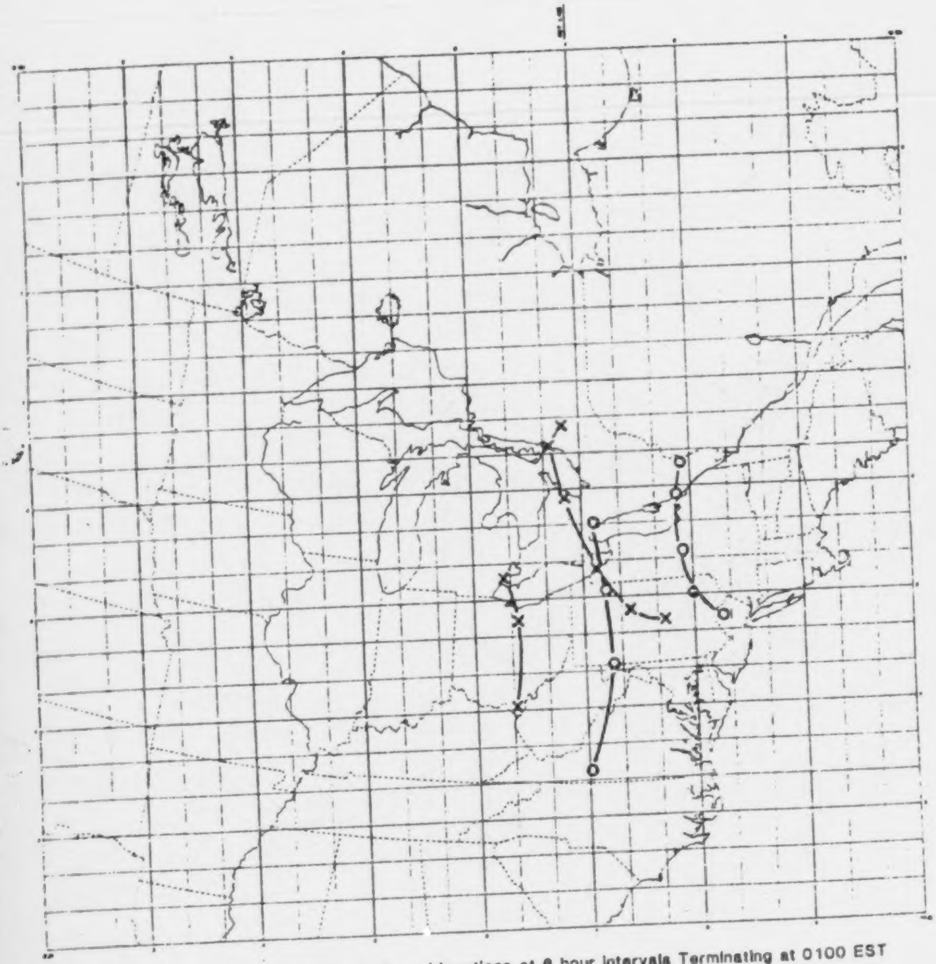
*US-Canada Memorandum of Intent on Transboundary Air Pollution - Emissions, Costs & Engineering Assessment, Interim Report, Feb. 1981

ATMOSPHERIC REACTION OF SO_2

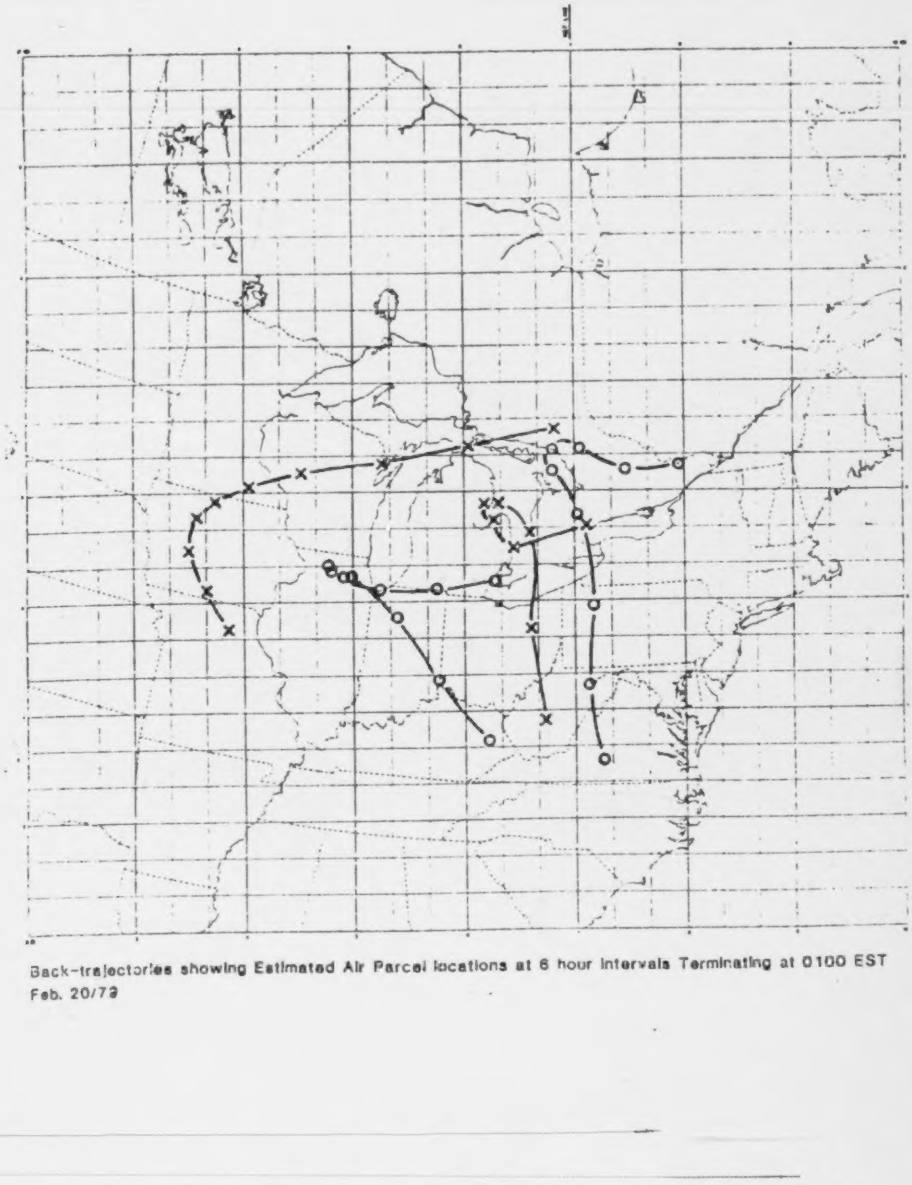

SO2
Homogeneous
Heterogeneous
OH
HO2
RO2
1
Urban
Rural
Organic Compounds
NOx
Meteorology
- Season
- Time of Day
- Temperature
- Sunlight
- Relative Humidity
- Atmospheric Turbulence
A
H2SO4
T & R
NH3
M
2
Urban
Rural
Season
B
NH4HSO4
(NH4)2SO4
MSO4
Transport and Removal
Aqueous
Particles
C
3
4
D
Solubility
Rate of Solution
Seasonal
NH3
Metal Catalysis
(eg. Fe, Mn, V)
H2O2
pH
Relative Humidity
Temperature
H2SO4
NH4HSO4
MSO4
Transport and Removal
H2SO4
NH4HSO4
MSO4
Transport and Removal

DEPOSITION PROCESS

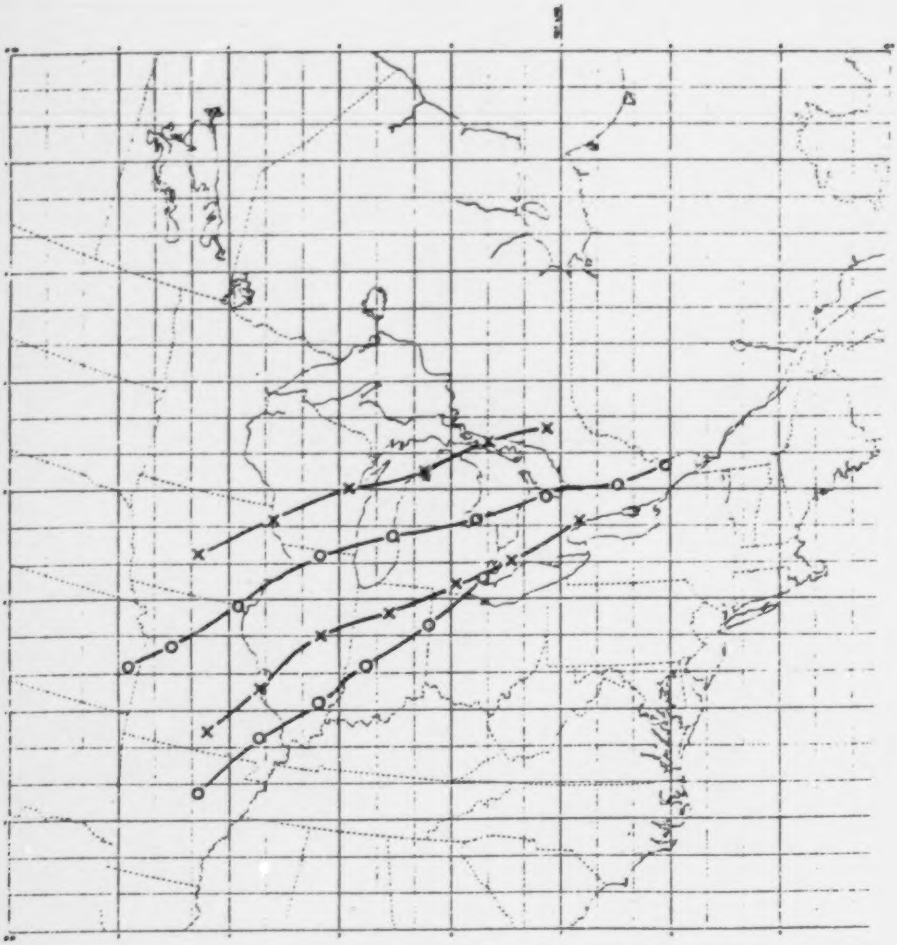

SO_2, NO_x, XSO_4, XNO_3, PAN
Gases
Particles
Ⓐ
Wet
Dry
Ⓑ
Particle/Droplet size spectra, chemical reactivity, surface conditions, meteorological parameters
Ⓒ
Wet
Dry
Ⓓ



Back-trajectories showing Estimated Air Parcel locations at 6 hour intervals Terminating at 0100 EST Feb. 19/79



Back-trajectories showing Estimated Air Parcel locations at 6 hour intervals Terminating at 0100 EST Feb. 20/79



Back-trajectories showing Estimated Air Parcel locations at 6 hour intervals Terminating at 0100 EST Feb. 21/79

Contributions of wet sulphur deposition from
20 U.S. power plants including Avon Lake and
Eastlake under various emissions cases to
environmentally sensitive areas in Canada and
the U.S.

Note: Each column presents data connected with the plants' emissions, as described. Where noted, the data are expressed as wet deposition percentages, with the normalizing factor being the total wet deposition occuring in 1979 due to actual emissions from all sources. This is the data listed in the first column.

Note: Model predictions have been verified to be accurate within a factor of 2 with 60% of estimates within 35% of expected values.

Sensitive Region	Total Wet Sulphur Deposition g/m^2/yr.	Per Cent Amount due to actual 1979 emissions	Per Cent Decrease occuring if 1979 actual emissions were reduced to 1979 SIP maximums.	Per Cent Increase occuring if emissions rise from actual 1979 levels to proposed new limits	Per Cent Increase occuring if emissions rise from 1979 SIP max to proposed max.	Per Cent Amount due to emissions if they are held at 1979 SIP limits (Column 1 minus 2)	Per Cent Amount due to emissions if they rise to proposed new limits (Column 1 plus 4)
Muskoka-Haliburton, Ontario	0.67	4.5	2.0	1.4	3.4	2.5	5.9
Algoma, Ontario	0.47	3.0	1.3	0.9	2.2	1.7	3.9
Lakehead, Ontario	0.28	1.9	0.8	0.7	1.4	1.1	2.6
Val D'Or, Quebec	0.61	2.7	1.1	0.8	2.0	1.6	3.5
Adirondacks, N.Y.	0.83	5.5	2.3	1.9	4.3	3.2	7.4
West Pennsylvania	1.94	11.4	3.4	5.0	8.5	8.0	16.5

Annual Wet Deposition of Sulphur

Total Magnitude and Percentage Contribution of the 53 Sources

Cited by Pennsylvania and New York* to the Total

Sensitive Region	Total Wet Sulphur Deposition (g/m^2/yr)	Amount due to 53 Sources Listed	Amount due to 0.2 g/m^2/yr 'Background'	Amount due to Sudbury 1979 Emissions	Amount due to Other Canadian Sources	Amount due to Other US Sources
Muskoka-Haliburton, Ontario	0.67	6.4	29.6	15.1	6.1	41.8
Algoma, Ontario	0.47	4.3	41.8	9.7	14.9	28.8
Lakehead, Ontario	0.28	2.9	70.8	1.3	4.8	19.9
Val D'or, Quebec	0.61	4.0	32.5	12.0	25.4	25.6
Adirondacks, N.Y.	0.83	8.4	23.9	4.1	5.7	56.4
West Pennsylvania	1.94	24.2	10.3	0.4	0.7	61.2

*"Federal Register", Vol. 46, No. 84, May 1, 1981
"Inside EPA", Vol. 2, No. 17, April 24, 1981

NOTE: Model Predictions have been verified to be accurate within a factor of 2 with 60% of estimates within 35% of expected values.

ONTARIO MINISTRY OF THE ENVIRONMENT

DR. T.G. BRYDGES
SUPERVISOR,
LIMNOLOGY UNIT

NOTES FOR REMARKS TO:

THE UNITED STATES SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

ALBANY, NEW YORK

WEDNESDAY, JULY 1, 1981

The Minister has indicated that the present acid loadings are causing unacceptable damage to our lakes and streams and I will briefly give some examples of these effects.

I will be tabling a set of seven photographs and graphics on slides in support of my comments for the committee's reference.

In Canada and the United States, we have tens of thousands of lakes in Precambrian rock areas which have been affected by acid rain. They support an extensive and unique ecosystem containing hundreds of species of fish, birds, mammals and other life. This is one of the great wilderness areas of the world and includes one of our most important recreational areas, Muskoka-Haliburton. One slide I will leave you shows a typical lake in this resort area.

In a second slide you will see one of the sampling structures designed to measure flow of water into and out of the lakes. The chemical composition of the water is frequently measured and the "substance budgets" for the lakes are calculated. This gives information on water quality, rates of change of quality and on the fate of the materials deposited in the lakes and watersheds from the atmosphere.

THE NEXT SLIDE SHOWS A SAMPLING STRUCTURE (WEIR) IN THE WINTER TIME. SAMPLES ARE COLLECTED FOR 12 MONTHS OF THE YEAR. ACIDS DEPOSITED WITH THE SNOW ACCUMULATE DURING THE WINTER AND DURING SPRING SNOWMELT, A "SHOCK" OF ACID FLOWS THROUGH THE STREAMS RESULTING IN SHORT TERM WATER QUALITY CONDITIONS WHICH CAN BE LETHAL TO FISH.

IN A TYPICAL STREAM ATTACKED BY ACID RAIN, AS THE WATER FLOW INCREASES, THE "SHOCK" LOADING OF ACIDS CAUSES PH TO DECREASE. IN THE EXAMPLE I AM TABLING, THAT DECREASE IS A FULL UNIT (I.E. A TEN FOLD INCREASE IN ACID CONTENT OF THE WATER). IT MUST BE EMPHASIZED THAT CURRENT ACID LOADINGS IN SNOW ARE CAUSING THIS PHENOMENON TO OCCUR EACH YEAR. HISTORICAL TRENDS IN ACID LOADING, WHICH ARE THE SUBJECT OF MUCH CONTROVERSY, ARE NOT PARTICULARLY RELEVANT TO THIS OBSERVATION.

YOU WILL ALSO SEE A GRAPH OF ONE OF OUR STUDY LAKES, PLASTIC LAKE. HERE, THE SPRING SNOWMELT HAS CAUSED FISHKILLS OF ADULT FISH IN THE WILD POPULATION. THE EFFECT WAS FURTHER DOCUMENTED THIS PAST SPRING BY PUTTING CAGED FISH IN THE LAKE AT VARIOUS LOCATIONS. MORTALITY WAS 100% IN 2 DAYS NEAR ONE INLET COMPARED TO NO MORTALITY IN 4 DAYS IN A CONTROL LAKE OF HIGHER PH.

We can see further effects on the fish population by comparing two lakes of varying sensitivity. As you will see, the white sucker population in Crosson Lake has the same age class distribution as George Lake had when the pH declined. We assume that Crosson Lake is experiencing damage from the short term water quality effects. This tendency toward younger fish, which can lead to complete loss of the population, has been observed in study lakes in Scandinavia as well.

Finally, I want to indicate our understanding of the extent of damage to our lakes.

Clearly, the detailed lake studies I have discussed are very costly in time and resources and data of such detail can only be collected in a small number of lakes. It is then necessary to extrapolate these observed effects to other lakes where we have very limited data.

We feel that the lake alkalinity is a good measure of the lake's resistance or sensitivity to effects of acid deposition.

From alkalinity data for lakes we have analyzed to date, it can be seen that from about 30% to 90% of the lakes in different areas fall in the sensitive or extreme sensitive category. This, too, is illustrated in our support material. From this data we conclude that biological damage is occuring during spring snowmelt in thousands of our lakes. This damage can only become worse as time goes on unless the acid deposition is reduced.

Every increase in acid deposition drives more nails into the coffins of our lakes, rivers and wildlife. Conversely, every reduction will help to reduce the stress in terms of the numbers of lakes affected and the severity of those effects.

That is the issue for the aquatic scientists, the choice of action is yours!

ACID DEPOSITION - POTENTIAL EFFECTS ON FORESTRY AND AGRICULTURE

DR. R.A.N. MCLEAN
ENVIRONMENTAL SCIENCES GROUP
DOMTAR INC.
RESEARCH CENTRE,
SENNEVILLE
QUEBEC, CANADA

A Brief Presented to:

United States Senate Committee on Environment and Public Works

Clean Air Act - Hearing on Acid Precipitation

Chairman - Daniel P. Moynihan

Albany, New York
July 1st, 1981

/sk

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INTRODUCTION

The task of amending the Clean Air Act would be onerous enough if it were only to address making improvements to achieve the aims of the 1970 and 1977 versions. However, in recent years the damaging and potentially disastrous effects of the long range transport of air pollutants (LRTAP) or "acid rain" have been recognized and demand a top priority consideration in the present amendment exercise. The nature of LRTAP is such that Congress must take a global view of air quality instead of the present position of setting air quality standards on a local or regional basis. As such it is to be hoped that, in addition to the aim of "how best to achieve and preserve clean air in our country" (as expressed in an editorial in Environmental Science and Technology, May 1981), Congress will make due consideration of the impact of its amendments on other countries.

The presently recognized damaging effects of "acid rain" require some immediate curative action and the establishment of a mechanism for applying more stringent measures to counter some of the potentially more damaging effects.

This brief covers a subject related to the emission and long range transport of atmospheric pollutants in Eastern North America and the resulting "acid rain problem" for which it is impossible at present to definitively establish negative effects - the impacts on agriculture and forests.

For the purposes of this brief and unless otherwise stated acid rain is defined as the deposition in rain, snow or in dry form of acid substances emitted from sources long distances (>100 km) from the receptor area which itself is not significantly affected by local sources.

Before commencing on these subjects, I summarize the accepted facts on the subject of acid rain and give a brief description of the situation in Quebec.

1. The quantities of acid deposition from the atmosphere to much of the Eastern U.S. and Canada are several times higher than those in "background" regions. These regions also experience deposition higher than observed in the much smaller area of Southern Scandinavia where it has been shown that acid rain has

caused the elimination of fish populations and other biological changes in hundreds of lakes and rivers in recent years.

2. Acid deposition in Eastern North America has given rise to well-documented increases in the acidity and decreases in buffering capacity in river and lake waters over a wide area including Pennsylvania, New Jersey, New York, New Hampshire, Ontario and Nova Scotia. This acid deposition has adversely affected fish populations in the lakes and rivers of these areas. Other possible causes of acidification of these waterways have been discounted.

3. The observed changes during acidification of lakes remote from industrial sources in affected areas have been (roughly in evolving order):

    - Increase in sulfate level in the water.
    - Loss of lake carbonate buffering capacity.
    - Increase in concentrations of toxic metals such as aluminum (in water), mercury (in fish).
    - Decrease in the diversity of organisms such as plankton, insects, etc.
    - Increase in the populations of acid resistant organisms.
    - Lack of reproduction of the most sensitive species, such as trout and salmon.
    - Decrease in the population of all plankton, insects, and fish.
    - Elimination of all the fish species, even the most acid resistant such as perch.
    - Growth of sphagnum mosses and acid resistant algae in the lakes. Even at present rates of deposition of acid from the atmosphere, more waterways will continue to acidify.

4. The major cause of the acidity of precipitation which is acidifying waterways is the emission of sulphur oxides (mainly sulphur dioxide) in the combustion of fossil fuels and the smelting of ores.

In order to firmly establish that an observed effect has been caused by acid deposition, it is necessary to carry out careful holistic ecological studies preferably over a period of time long enough to observe the effect developed and to eliminate all other possible causes. This type of study has been carried out in a few regions of Eastern North America including Hubbard Brook, New Hampshire, the Adirondack Park, New York, the Muskoka Haliburton Region, Ontario. Until now very little work has been done in the largest acid sensitive area in North America, the Laurentian Shield of Quebec.

THE ACID RAIN SITUATION IN QUEBEC

Quebec has an area of approximately 1.54 million km^2, and has approximately half a million lakes covering 184,000 km^2. On the basis of the major bedrock structure, it can be divided into three regions in order of increasing sensitivity to acidification:

1) The St. Lawrence lowlands,
2) The Appalachian Highlands to the south to the U.S. border and
3) The Canadian Shield to the north with a precambrian granitic bedrock and very little buffering capacity against acid input which covers more than 90% of the area of the province.

This Shield area is several times greater than the area of unbuffered granitic bedrock in any other province of Canada or state of the U.S. In addition to this, as can be seen from Figure 6 of the latest U.S.-Canada Research Consultation Group Report on the long range transport of air pollutants (November 1980) almost all of the Shield area has soils and sediments which are readily acidified. The area of Quebec which receives, on an annual basis, precipitation as or more acidic (pH = 4.7) than that considered to cause damage to the most sensitive lakes in Southern Scandinavia is more than 600,000 km^2 or more than twice the impacted area in Southern Scandinavia and somewhat larger than the area of New York, New England, Pennsylvania, and New Jersey combined.

Considering these facts it is surprising that very little has been heard from Quebec on the subject of acid precipitation. There are several explanations: Firstly the waterways in the most populated region of Quebec, the St. Lawrence Valley, where more than 90% of the population lives, are well buffered and are unlikely to be affected by acid precipitation. Secondly, most of the rivers and lakes in the populated area are so highly polluted from local sources (the sewage from 95% of the population still goes directly to the rivers untreated) that the provincial governments' top priority is the clean-up of these sources. Finally, there have been few complaints, as yet, from the angling community. The loss of fish from lakes has always been put down to overexploitation and there has been little investigation of any other potential causes.

In spite of this lack of attention to the problem in Quebec until now, work has been accelerating rapidly in the last few months and a number of surveys have been carried out which have revealed the extreme sensitivity of Quebec's waters to acidification. In a recent survey of 1300 remote lakes of average area over four km^2, almost 50% have pH of less than 6 and 10% have a pH of less than 5. This survey was not planned to investigate the impact of acid rain and a number of the lakes would be naturally acid humic lakes but, on the other hand, there were few of the more sensitive headwater lakes included. It has also been discovered in some of the famous fishing areas in the St. Maurice Valley and Laurentide Park that lakes have been acidified recently and that fish populations have been diminishing. It is not possible as yet to relate this directly to acid precipitation, but there is little question that it will be found to be a principal cause.

Sport fishing in Quebec is very popular, is a major industry ($500 million/yr) and most of it takes place in waters which are threatened by acidification. As with other states and provinces in the North East, Quebec would like to see this threat removed. The population is not yet sufficiently sensitized to the issue, but it is becoming so and when it is recognized that sport-fishing is being affected, the pressures for action are likely to be as great as they have been in Ontario and in the Adirondacks.

This is especially so since by all estimations from recent model, Quebec is a net recipient of acid deposition. Quebec does have one of the largest single point sources in Eastern North America, a smelter in the North West which emits about 600,000 tons of sulphur dioxide per year. However, despite this enormous amount, in all the studies which have been carried out thus far it has been shown that this source does not make a significant measurable contribution to precipitation acidity and sulfate compared to the acid rain coming from the South, except within a 20 km radius of the source. Clearly, the emissions are being spread over a wide area and making their own contribution to the global sulfur disposition, but the absence of this source would not significantly change the amounts of sulfur deposited in Quebec.

ACID RAIN ON THE TERRESTRIAL ECOSYSTEM

As indicated above, it is recognized that acid deposition is causing a severe impact on the waterways in certain parts of Eastern North America, but the long term studies required to establish the impact of acid rain on our agricultural soils and forests have not yet yielded conclusive evidence. However, there is now indirect evidence that acid precipitation could be having a significant impact and, in the long term, causing much more severe economic losses than the acidification of waterways. There is a particular concern that acid rain may be causing a loss of nutrients from forest soils and that as a result tree growth is being hampered.

ACID RAIN AND AGRICULTURE

The negative effects of acidification on agricultural soils in leaching nutrients and increasing soluble aluminum concentrations and hence, reducing growth of many crops are well known. Farmers have understood this for centuries and have used lime to solve the problem. Even the impacts of acid rain on agricultural soils have been known for some time. Some of the conclusions being reached today in studies on the impact of acidification on microbial nutrient cycling in the soil can be found in papers from Britain and Germany around the turn of the century. C. Crowther and A.G. Rusten (J. Agricultural Science, 4, 25-55 (1911)) showed that soils receiving artificial sulfuric acid rain with a pH in the same range as observed during many storm events in the Eastern U.S. (3-4) show a decline in ammonifying, nitrifying and nitrogen fixing bacteria which provide much of the nitrogen nutrition for plants. For most of the U.S. and Canada the concern for the impact of acid rain on agricultural soils is not very great, since most of these soils are relatively well buffered against acidification and there are other factors which contribute more to the acidification of soils than acid precipitation, e.g. the extensive use of acidifying fertilizers such as ammonium sulfate, poor crop rotation practices and most particularly soil erosion caused by badly planned tree and shrub cutting. However, in Quebec, acid precipitation could be a more significant factor than in most other parts of the U.S. and Canada. More than 80% of the agricultural soils have pH's less than 6 and 57% have pH's less than 5.5. Quebec's agricultural land in total loses the equivalent of 1.2 to 1.5 million tons of limestone per year by leaching and erosion (≈50%), by removal with the crops (≈20%), by acid rain (≈20%), and by acidifying fertilizers (≈10%). If only the fertilized land is considered, approximately 0.5 million tons of limestone are lost per year with fertilizers causing about 25% of the loss. At present, only about 0.36 million tons of limestone are being supplied to the agricultural soils in Quebec to neutralize the increased acidification. This amount barely compensates for losses due to acid rain alone (0.28 million tons). Even though acid rain is not the major factor in agricultural soil acidification, it still helps to increase the farmer's bill for limestone. Clearly improved management of agricultural land is required to reduce the rate of deterioration of agricultural soils. This is now realized and steps are being taken at the local levels in many areas to deal with it. Acid rain is the only factor outside local control and it is one that the farmers of Quebec, at least, could probably do without.

The farmer is aware that acidification is taking place and that the resulting increases in available aluminum and decreases in nutrient reduce productivity. Nevertheless, with adequate applications of limestone and increasingly, with better land management methods to prevent acidification, these effects can be reduced. However, for the forests, it is a different matter.

ACID RAIN AND THE FORESTS

The picture of the impact of present levels of acid precipitation on the forest is somewhat contradictory and no adequate cause-effect relationships have been established. Acid precipitation at present levels has been shown to have a positive, a negative and no effect on forest vitality, and tree growth, depending on conditions, but has generally been shown to affect the cycling of nutrients. However, most studies were done under conditions in which it is possible that a number of other important variables other than acid precipitation were not considered. With some increase in the acidity (to pH 3.0-3.5), it is known that the effects on vegetation, both direct (foliar damage) and indirect (tree growth), are mainly negative. Notwithstanding a possible relationship with acid deposition, the forests of North Eastern North America appear to be under considerable stress, with evidence of declining growth rates for a number of species over the last 25 years, of increase in disease and poor natural regeneration.

Considerably more effort is required in studying the stress on our forests and all of its possible causes.

Over the past decade the forest industry has been expanding its use of full or complete tree harvesting instead of leaving behind on the forest floor branches, leaves, needles, etc. Many experimental and modelling studies have been carried out to evaluate the impact of this increased removal of nutrients and organic matter on the second rotation. In many studies on poor to moderate quality soils, it was considered that full tree harvesting would require fertilization to prevent nutrient deficiencies. On better quality soils the problem was likely to be less severe. However, none of the studies referred to considered the added impact of "acid rain" on leaching of nutrients etc. It is considered that the effect of acid rain in areas which have been clear cut could be especially serious because of the increased leaching of minerals from the soils.

FOREST GROWTH RATES AND "ACID RAIN"

In any consideration of the impact of acid rain on the forest, it must first be recognized that there are many "forests" with great differences in nutrient requirements, resistance to disease etc. which will react differently to small perturbations (e.g. a five fold increase in acid deposition) even though they may all react the same way to large perturbations (e.g. hundred fold increases could cause death). As might be expected then the observed relationships between acid deposition and forest growth have varied widely.

In Sweden in the early 1970's it was suggested that forest growth had decreased as acid deposition increased. More extensive field studies in softwood forests in Norway revealed no clear evidence of decreasing productivity or tree growth. One reason why the comparatively low softwood forest production is not reduced by acid precipitation is the large quantities of mineral nitrogen as nitric acid coming with the acid rain. The growth rates of most of these forests are limited by the availability of mineral nitrogen and as such any negative effects of increased acid on forest growth could be compensated for by increased nitrogen fertilization.

In parts of Australia forests are sulfur deficient and attempts have been made to site moderate sulfur emitters close to valuable forests on alkaline soils to increase their sulfur levels.

At the opposite extreme the total destruction of forest vegetation has been observed over a period of a few years, in the immediate vicinity of many sources of sulfur dioxide emissions (e.g. Sudbury, Ontario). At intermediate levels of impact as are observed now in many areas of central Europe (e.g. the Solling forest in Germany, see attached report by G.H. Tomlinson), advanced rates of acidification of forest soils with increased available aluminum, have been reported. This has been related to the observed damage to fine roots and decreased tree growth.

Reports of decreased tree growth, poor regeneration and damage have come from many forested areas in Eastern North America receiving elevated inputs of acid deposition and, although it is at present impossible to establish satisfactory cause-effect relationships, there have been many well-voiced suspicions. Some of the strongest evidence is now appearing from the U.S.

Recently it has been observed that many of the forests in Eastern North America are under considerable stress with decreasing growth rates, yellowing of foliage, crown dieback, and increasing mortality over a wide area, but especially in areas of known impact of acid deposition on stream and lake chemistry. A.H. Johnson et. al. (University of Pennsylvania) have reported (J. Environ. Qual. (1981) in Press) "an abnormal decrease in growth rates over the past 25 years" in all species and all ages of trees both in plantations and native in the Pine Barrens of New Jersey. D.J. Raynal et. al. (State University of New York, Syracuse) found that from 1940 to 1976 white pine in the Huntingdon Forest in the Adirondacks had a yearly growth 0.27 mm less than expected from earlier growth patterns. The Red Spruce in the Green Mountains of Vermont have been found by T.G. Siccama (Yale University, New Haven) and H.W. Vogelmann (University of Vermont, Burlington) to have decreased considerably in density and growth rate between 1964 and 1979. Vast and increasing numbers of dead and dying red spruce and trees with damaged foliage can be observed throughout New England in the Adirondacks in New York and the White Mountains of New Hampshire as well as the Green Mountains of Vermont.

The above authors claim to have eliminated the major known factors which could have the observed effects on the forests studied, e.g. drought, fire, pests, etc. In all cases, they suggest the long range transport of air pollutants particularly acids into these remote areas as the possible cause. More specifically, Johnson et. al. have also eliminated the possibility that atmospheric oxidants are a cause and show that the decrease in growth is directly related to increased stream water acidity. A causal relationship with acid precipitation has been suggested and this is difficult to challenge since other possible causes have been eliminated.

Although there is little reliable data on tree growth, in many areas of Quebec the poor natural regeneration of the forest is causing great concern to the forest industry. It is, at present, impossible to link this to acid precipitation. Most Quebec forest soils are already very acidic and as with agriculture, other human activities such as suppression of hardwood forests and clear cutting may be as significant contributers to increased podzolisation.

Last year one of North America's leading analysts on the health of the forest stated "...if nothing is done (to prevent the negative impact of acid rain) until a growth decline is large enough to be detected by conventional approaches, then the damage will be irreversible and the problem incurable". (P.J. Rennie, Canadian Pulp and Paper Industry, August 1980, p. 28.) If the conclusions from the U.S. studies quoted in this section are confirmed, that point may not be far off.

In conclusion, although the evidence is reasonably conclusive only in one study that "acid rain" is the causative factor in the widely observed decrease in growth and other damage in the forests of Eastern North America, there is sufficient cause for grave concern. It will not take many more studies of the type described above to convince the scientific community as a whole that effects of acid rain are being observed in the forest as well as in lakes and rivers. The research effort in forestry has, until now, been meagre and it is surprising how much has been achieved. There is little doubt that some damage is taking place that could seriously affect the forest in the long run, but greatly increased efforts are required to ascertain the present rates of damage.

At the same time, however, we cannot afford the luxury of establishing the exact rate at which different parts of the ecosystem are acidifying before taking action to deal with the situation. Clearly, the emissions of gases which acidify the ecosystem must be reduced. However, at the same time much presently unrecognized damage will continue. Research programs on management methods to remedy and prevent further damage from acidification should be as vigorously pursued in impacted areas as studies on the damage phenomenon. At present this is not happening.

CONTROLS OF EMISSIONS OF SO_2 AND NO_x TO PROTECT ACID SENSITIVE ECOSYSTEMS

Projections of U.S. emissions of sulfur oxides and nitrogen oxides over the next twenty years, based on existing regulations and abatement technology, indicate that sulfur oxide emissions are going to be relatively stable and that nitrogen oxide emissions will continue to increase. Growing concern has been expressed that nitric acid deposition is causing considerable acidification of natural waters and soils in Eastern North America and that this impact will increase in the coming years. This concern arises partly from the assumption that equivalent amounts of nitric acid and sulfuric acid contribute equally in their ability to acidify the terrestrial and aquatic ecosystems. It is a relatively easy step, from this assumption to suggest, that the past and present emphasis on the control of emissions of sulfur oxides will not achieve the desired aim of making a significant reduction in the effects of acid rain, as long as nitrogen oxide emissions are less well controlled. Unfortunately, the technology for controlling the more diffuse nitrogen oxide emissions is less advanced than that for controlling sulfur oxide emissions from the relatively few large stationary sources.

In Eastern North America most of the vegetation is nitrogen deficient and requires atmospheric inputs of nitrogen as a nutrient, but little of the vegetation is sulfur deficient. Therefore, nitrate from nitric acid is readily consumed. In the consumption of nitrate, acid is used up and therefore, nitric acid in precipitation is not available to cause further acidification damage. Therefore, unlike sulfuric acid in acid rain, nitric acid is not a significant contributor to long term acidification of the environment in remote areas*.

* Although in the long term, nitric acid in atmospheric precipitation is not likely to be contributing to the overall acidification of the environment, during the spring thaw, in areas which have been heavily impacted by acid rain for a number of years, nitric acid which has concentrated in the snow pack over the winter may cause severe ecological damage especially to fish populations.

Though there is little doubt that tighter controls are necessary to diminish the effects of "acid rain" the existing control strategies, which have put more emphasis on the control of emissions of sulfur oxides than nitrogen oxides, have a reasonable scientific basis given our present limited knowledge of the effects on the ecosystem.

By all means, controls of nitrogen oxides are necessary to protect human health, etc. But let us not dilute our efforts to solve the acid rain problem by attacking more than the true source of the problem sulfur oxide emissions. In attempting to set standards for acceptable levels of acid deposition to protect sensitive waterways, work group I of the U.S.-Canada Memorandum of Intent on Transboundary Air Pollution has chosen to consider only sulfuric acid deposition. They have suggested an upper limit of 10 kilogram/hectare/year whereas most of Eastern North America at present receives 30 to 50 kg/ha/yr or more. Based on a consideration of the terrestrial ecosystem, this approach would be acceptable.

It is recommended that this be taken into consideration where amendments are made to the Clean Air Act to deal with the acid rain problem.

THE RELATIVE CONTRIBUTIONS OF SULFURIC AND NITRIC ACIDS IN ACID RAIN TO THE ACIDIFICATION OF THE ECOSYSTEM

Implications for Control Strategies

by R.A.N. McLean
Domtar Research Centre
Senneville, Quebec

A Brief to be Presented to the Sub-Committee on Acid Rain, House of Commons Standing Committee on Fisheries and Forestry.

26 January 1981

CONCLUSIONS

1. All the long-term small scale watershed budget studies indicate that much of the nitric acid in acid rain is decomposed in the soils and waterways. This decomposition uses up acid. Therefore, unlike sulfuric acid in acid rain, nitric acid is not a significant contributor to long-term acidification of soils and waters.

2. Another component of acid rain, ammonium salts can cause acidification when the ammonium ion reacts in soils and waters. Until now this contribution to acidification of acid sensitive areas has been largely ignored.

3. Although over the year, nitric acid in atmosphere precipitation is not likely to be contributing to the overall acidification of the environment, during the spring thaw, in areas which have been heavily impacted by acid rain for a number of years, nitric acid which has concentrated in the snow pack over the winter may cause severe ecological damage especially to fish populations.

4. Sulfuric acid in atmospheric deposition at present remains a greater menace to the aquatic and terrestrial ecosystem than equivalent amounts of nitric acid.

RECOMMENDATIONS

1. An assessment of the effects of long term inputs of nitric acid in atmospheric precipitation over the whole of eastern Canada should be carried out. This is required to ascertain the generality of the conclusion, reached here, that present levels of nitric acid input from the atmosphere are causing much less acidification than equivalent amounts of sulfuric acid. Extensive ecosystem modelling will be required.

2. A detailed assessment of the potential acidification impact of atmospheric inputs of ammonium salts in eastern Canada is required.

3. There is an urgent requirement for detailed studies on the storage of nitric acid in snow pack in sensitive areas of Eastern Canada. The effect of the rapid release of this nitric acid on aquatic life has to be evaluated.

4. More extensive effort is required in examining if there really is any serious environmental impact of nitric acid in acid rain. This should be done before enormous sums are spent on research into the sources, transport and transformations of nitrogen oxides in the atmosphere.

5. It is believed that the existing control strategies, which have put more emphasis on the control of emissions of sulfur oxides than nitrogen oxides have a reasonable scientific basis given our present knowledge of the effects on the ecosystem.

6. However, there is an indication that more stringent control of nitrogen oxides in the winter compared to the summer could have considerable ameliorative effects during the spring thaw.

Since 1960, sulfur dioxide (SO_2) emissions to the atmosphere in North America have increased slightly (by approx. 24%)**. From the little data available, the concentrations of sulfate* (which are largely the result of the SO_2 emissions) in the atmosphere and in the rain and snow of Eastern North America seems to have remained constant or even decreased somewhat during the 1960's and 1970's (see Table 1). However, over the same period there has been a large increase (120%) in the emissions of nitrogen oxides and a significant increase in the concentration of nitrates* in precipitation. Projections of U.S. emissions of sulfur oxides and nitrogen oxides over the next twenty years, based on existing regulations and abatement technology, indicate that sulfur oxide emissions are going to be relatively stable and that nitrogen oxide emissions will continue to increase. There is now a growing concern that nitric acid deposition is causing considerable acidification of natural waters and soils in Eastern North America and that this impact will increase in the coming years. This concern arises partly from the the assumption that equivalent amounts of nitric acid and sulfuric acid contribute equally in their ability to acidify the terrestrial and aquatic ecosystems. It is a relatively easy step, from this assumption, to suggest that the past and present emphasis on the control of emissions of sulfur oxides will not achieve the desired aim of making a significant reduction in the effects of acid rain, as long as nitrogen oxide emissions remain uncontrolled. Unfortunately, the technology for controlling the more diffuse nitrogen oxide emissions is less advanced than that for controlling sulfur oxide emissions from the relatively few large stationary sources.

In this presentation, it will be shown that the contributions of nitric acid and sulfuric acid to the acidification of the terrestrial and aquatic ecosystem by atmospheric deposition are not equivalent and that, except possibly during the spring thaw, nitric acid in precipitation contributes considerably less to the acidification of the ecosystem. As in Scandinavia, sulfuric acid in precipitation is still the more serious threat to the ecosystem of Eastern North America.

Despite the increase in the amounts of nitrates in precipitation in recent years, in none of the regions studied in Eastern Canada and the U.S. is the annual input

* see Appendix.

** During the period regulation of sulfur emissions has resulted in the conversion from high sulfur to low sulfur fuels in spite of increased use of fuel in this period.

of nitrate from precipitation more than 60% of the contribution of sulfate in determining the acidity of atmospheric precipitation. Therefore, even if nitric acid and sulfuric acid are equivalent in their ability to acidify the terrestrial and aquatic ecosystems, sulfuric acid is still the main contributor to acidification. Of course at the present rate of increase in nitrogen oxide emissions it may not be long before nitric acid becomes the main contributor to the acidity of precipitation in Eastern North America. Therefore we urge a full evaluation of its potential effects.

To assess the impact of acid rain on the aquatic and terrestrial ecosystem we must examine the fate of each of the ionic constituents in the rain after it has travelled through the soils and water. The simplest way to do this is to make ion budgets. A number of long term studies have been carried out to measure the quantity of ions going into a lake or stream watershed from the atmosphere in rain etc. and the quantity coming out at the exit of the lake or stream. Some examples are given in Table 2. For the acid hydrogen cation the output is usually much less than the input since hydrogen cation replaces other cations such as calcium, magnesium and potassium from soils, sediments and rocks, therefore these latter ions have much greater outputs than inputs. This process is one of these which neutralises the acid rain. However, it is removing cations which are essential for the growth of plant and animal life and eventually, in areas with limited supplies of available life supporting cations, the acidity of the waters and soils will be increased and life processes will be effected. The sulfate, which is associated with the hydrogen ion in the acid rainfall, usually has an output which is the same or slightly higher than the input. Therefore sulfate from the rainfall can be considered to be relatively unreactive and goes through the watershed unchanged. However for nitrate it is observed that output is much less than input (usually less than 25%). Since nitrogen is an essential element for all living things it is not surprising that one of its forms which is relatively reactive, i.e. nitrate, should be utilised in the watershed. Nitrate (or nitric acid) can form a number of products when it reacts in the ecosystem but one of its most common reaction is the reduction to nitrogen gas (the so-called "denitrification") as follows;

$$HNO_3 + 5e^- + 5H^+ \longrightarrow 1/2\ N_2 + 3H_2O$$

The most important point to note is that, in the reduction reaction of nitrate or nitric acid, five moles of hydrogen cation are used up for each mole of nitric acid. The amount of acid hydrogen cation used up will vary depending on various other conditions but the more nitrate utilised the more acid used up. In all cases the amount of acid in the system will be lowered. Therefore additions of nitric acid to an ecosystem subjected to acid precipitation should not only not cause acidification but may even reduce the acidity of waters and soils if sufficient reduction of the nitric acid takes place. It is well known that the addition of nitrate to agricultural soils can cause a reduction in the acidity of soils.

In contrast to nitrate with any associated hydrogen cation (i.e. nitric acid) sulfate is not being significantly utilised in the ecosystem. Though nitrate is able to neutralise the acid hydrogen cation which came with it in acid rain, sulfate is generally incapable of this. Therefore sulfuric acid in acid rain will contribute to long term acidification, whereas nitric acid will not, provided that the nitrate is reduced. As waters become more acid, they may become less capable of allowing nitrate to be reduced so that eventually nitric acid from the rainfall will not be used up and will therefore contribute to the acidification of the waters. However this will only occur after extensive acidification.

From this it must be concluded that in general low inputs of nitric acid from the atmosphere will not cause acidification to the extent that an equivalent amount of sulfuric acid does.

Until now little study has been made of inputs of ammonium ion from the atmosphere. In long term budget studies in small watersheds it appears to be mostly utilised since output is very low. Now in contrast to nitrate, some of the reactions the ammonium cation will cause acidification e.g.

$$NH_4^+ + 2O_2 \dashrightarrow NO_3^- + 2H^+ + H_2O \quad \text{(Oxidation)}$$

Not all of the ammonium ion will react in this way but it clearly has the potential to acidify waters when it reacts. Nitrate will always reduce the acidity when it reacts. Further work is required on the fate of ammonium ion inputs to acid-sensitive areas, since, if it is causing more net acidification than nitrate, it would be more logical to control emissions of ammonium to the atmosphere than emission of nitrogen oxides.

Although in the long term the addition of nitrate at present levels may not be causing acidification, nitric acid accumulation in snow pack over the winter could cause more serious problems during the spring thaw. The addition of nitric acid in the rain at present levels is causing considerably less acidification than the addition of sulfuric acid. However, the accumulation of nitric acid in snow pack over the winter in North-Eastern America may be having significant ecological effects.

The concentrations of nitrate in rain and snow vary little with the time of year whereas the level of sulfate reaches a maximum in the summer (when on average it is 4-5 times the equivalent nitrate concentration) and a minimum in the winter (when nitrate and sulfate in precipitation are about equivalent). In addition since sulfate leaches to a great extent from the snow pack (much of it as sulfuric acid) during the winter, nitric acid appears to accumulate. Thus during a rapid thaw in the early spring after a winter where there has been a heavy snowfall with few periods above 0°C, the first run-off water which is the most acid could have much higher than normal amounts of nitric acid.

Since the early spring is also the most sensitive time of year for most aquatic life forms it is extremely important to know the fate of the nitric acid released in snowpack. Very few studies have been carried out on this subject. Some studies in Scandanavia showed that even at this time of year nitric acid reacts fairly rapidly and hence as indicated above, the acid is used up. However more recent data from the Adirondacks show that the nitric acid does not react as rapidly during the spring thaw and, in this area, may now be the major contributor to the sudden drop in lake and stream water pH often observed in acid sensitive areas during early spring. Further work is required to confirm that most of the nitric acid observed in the waters comes from snow and not from the oxidation of ammonium ions.

Much of northeastern North America has been receiving precipitation of pH 4.6 or less i.e. more than ten times more acid than "normal" rain (pH = 5.6) for the past twenty to thirty years. Originally this acidity was almost totally due to sulfuric acid. These inputs of sulfuric acid in the very acid sensitive Aderondacks may have removed much of the neutralising and nitrate-utilisation ability of the soils and waters. Further work is required on this subject.

TABLE 1

SULFATE AND NITRATE IN ATMOSPHERE PRECIPITATION AT HUBBARD BROOK, NEW HAMPSHIRE
(from Likens et al 1977)

YEAR	Mean Concentrations (uequiv/l) Sulfate	Nitrate
1964-65	63	11
1973-74	55	27

TABLE 2

ANNUAL CHEMICAL BUDGETS FOR SMALL WATERSHEDS IN NON-CARBONATE AREAS

SITE	TIME PERIOD	Ratio of Output in Streams to Input from Precipitation				Reference
		H^+	Ca^{2+}	NO_3^-	SO_4^{2-}	
Lower Mersey River Nova Scotia	June 78 to May 79	0.42	3.3	0.03	1.6	Kerekes (1980)
Rawson Lake Ontario	1970-73	0.1	1.6	0.02	1.1	Schindler et al (1974)
Harp Lake Ontario	1977-78	0.02	2.4	0.24	1.6	Dillon et al (1980)

APPENDIX

Sulfate (SO_4^{2-}) is the anion or negative ion which, with 2 hydrogen cations or positive ions (H^+), is equivalent to sulfuric acid (H_2SO_4).

Nitrate (NO_3^-) is the anion which with, 1 hydrogen cation (H^+), is equivalent to nitric acid (HNO_3).

Strictly speaking in determining the chemistry of rain hydrogen cation, sulfate and nitrate are determined and not sulfuric acid and nitric acid. If all the sulfate and nitrate in rain were associated with cations other than hydrogen cation (H^+) the rain would not be acid. However since they are usually associated with a considerable amount of the acid hydrogen cation in Eastern North America we have acid rain. Since hydrogen is not the only cation in the rain it is not strictly correct to talk about sulfuric and nitric acids in the rain. The only other major cation in acid rain in remote areas is the ammonium cation (NH_4^+) and therefore acid rain is mainly a mixture of the ions H^+, NH_4^+, SO_4^{2-}, and NO_3^-.

PREPARED STATEMENT BY MICHAEL PERLEY
EXECUTIVE CO-ORDINATOR
CANADIAN COALITION ON ACID RAIN
TESTIFYING BEFORE SENATOR DANIEL PATRICK MOYNIHAN'S FIELD HEARING
OF THE U.S. SENATE ENVIRONMENT AND PUBLIC WORKS COMMITTEE,
ALBANY, NEW YORK, JULY 1, 1981

WHY ARE CANADIANS CONCERNED ABOUT ACID RAIN?

1. THE CANADIAN OUTDOOR HERITAGE:

Ask any Canadian how he or she spent their summers when they were young, and chances are the majority will have passed some time either at a summer camp, or at a cottage, or at least on a short fishing trip with a favourite uncle. The major southern cities in Ontario seem deserted during July and August, as Canadians head north to fish, water-ski, or just lie around next to the beer cooler at the cottage.

The northern wilderness forms part of the Canadian psychology: the fact that we have lakes, mountains and wilderness areas to explore and escape to is essential to many of us. Many of our families fought a hard battle against this wilderness before finally settling in Quebec, Ontario or the West in the 17th and 18th centuries.

Every Ontario cottager going north has his own belief as to where the air changes from the sullen, smoggy heat of the Lake Ontario coast line to the clear and invigorating air of the Muskoka-Haliburton region. Northern vacationers in Ontario and Quebec have their own customs: the inevitable first trip on the Victoria Day weekend in late May to open the cottage, repair the winter's damages, perhaps put the dock back in the water, and a first long tramp through the woods; inventing endless excuses to get away from the office early on Friday to beat the traffic north; waiting to hear the first loon of the season; and the rituals of barbecues, water-skiing, and a continuing search for a new fishing hole.

These are not the luxuries of a privileged few: they form an integral part of the life of Canadians from coast to coast. In Nova Scotia, the emphasis is on fishing, and the Atlantic salmon is the prize catch. Quebec's Laurentian mountains attract tens of thousands of American and Canadian visitors every summer, and winter skiing there is second to none. Northern Saskatchewan is dotted with lakes teeming with rainbow and lake trout, Albertans treasure vacations in the Alberta Badlands, and long hikes through the Rocky Mountain foothills. British Columbians treasure their salmon fishing on the coastline stretching to Kamloops, some 250 miles north of the B.C./Washington border.

Unfortunately, it is becoming clear to many Canadians across the country that the long range transport of air pollutants and resulting acid precipitation, much of which originates in the United States, is posing an increasingly severe threat to their prized outdoor heritage. Reductions in Atlantic salmon have been documented by Federal Government scientists working in Nova Scotia; at least 180 lakes are terminally acidified in Ontario, and another 48,500 are at risk; tourist outfitters in Northern Saskatchewan are concerned about potential acidification of prime fishing waters there from emissions originating in the Alberta tar sands plants; British Columbia coastal fishermen are concerned that the increasing acidity of rainfall documented on the lower mainland and the southern coastal areas will soon affect salmon fishing there.

Prize game fish are Canada's front line troops in the battle against acid rain. Following closely behind them are the tourism and recreation industry, particularly in Ontario, and the Canadian forest industry.

II TOURISM AND RECREATION IN ONTARIO

Among the over 1600 lodge and resort owners in Northern Ontario, optimism about the future of their industry is at a low ebb these days. Many owners participated in a 1978 study sponsored by the Ontario Ministry of Northern Affairs and the Northern Ontario Tourist Outfitters' Association, and study researchers were told about increasing costs and declining stocks of pickerel, northern pike and brook, rainbow and lake trout. Such prime game fish attract many Americans, who make up 65% of lodge and resort clients. Nearly 85% of these Americans travelled, on average, 700 miles to the North, spent an average of $675 per visit, and came for only one reason: the fishing. They and their Canadian counterparts generated more than $120 million in direct and indirect revenue in 1978, and created more than 10% of the 200,000 Northern Ontario jobs of all types available. For your further information, I have attached two items from Federal and Ontario government reports, which indicate how much the sport fishery was worth across Canada in 1975, and how many U.S. residents held angling licenses in Ontario in 1975. These surveys are done only once every five years, and I am told we may expect up-to-date figures this summer.

The majority of Ontario lodges are located in that part of the province where acid precipitation is heaviest. Hundreds are located on lakes which are moderately to extremely sensitive to acid precipitation. Indeed, one study done for the Ontario Ministry of the Environment in 1979 estimated that nearly 600 fishing lodges could go out of business within 20 years if acid precipitation continues at present levels, killing about 6,000 jobs and $28 million of annual income. According to Ontario Government statistics, almost one out of every two Ontario male residents and one out of every three female residents go fishing each year, spending an average of $154 a year on their hooks, rods, bait, hip waders and so forth. Ontarians and their American guests who fish spent $450 million on this activity in 1975. If we conservatively assume no increase in fishermen and 10% inflation per annum, it is safe to suppose that this figure will increase to about $840 million this summer.

But fishing is only a part of the Ontario tourism picture. Tourism is Ontario's second largest industry, directly accounting for $5 billion in annual revenue and 470,000 jobs - nearly 6% of the total gross provincial product and 11% of all the jobs. Nearly $900 million is spent in the northeastern section of the province from the Bruce peninsula to the Muskoka-Haliburton boundary, the most acid-sensitive area in the province. It is the cottage heartland of Ontario, which contains almost two-thirds of 250,000 such getaway retreats. Those cottagers directly spend $200 million a year in the area.

The fourth most important tourist area in Ontario was identified by a 1977 Ontario Ministry of Industry and Tourism study as being the Barrie-Parry Sound-Huntsville triangle. 90% of the visitors in that playground came from Ontario itself and, with outsiders, spent $96 million that year for a holiday in the area. But what the report failed to note is that the Parry Sound-Huntsville area is dead centre in Ontario's acid rain belt, where rainfall is from 40 to 100 times more acidic than normal.

In summary, a significant part of Ontario's tourism industry, the sport fishing sector, stands to suffer direct and substantial loss over the next 20 years if acid rain causing emissions are not reduced. This in turn will inevitably affect the overall tourism picture, as our Province gradually loses its reputation for clean lakes, abundant sport fish and wild fowl, and a pure and pristine environment.

An even more serious possibility, that of potential damage to Canada's forest industry, is also of serious concern to many Canadians.

III CANADA'S FOREST INDUSTRY

Serious attention is now being paid by Canadian Federal and Provincial governments to the question of the impact that acid precipitation may have on our forest industry. The forest industry is the mainstay and foundation of the Canadian economy, with exports for all forest products in 1980 totalling $12.5 billion, as against $1.0 billion in imports, for a net contribution to our balance of payments of $11.5 billion.

The forest products manufacturing sector alone directly employs 330,000 Canadians, and one of ten Canadian jobs depends directly or indirectly on the forest industry as a whole. In 1980 salaries and wages in the forest products manufacturing sector totalled $1.7 billion.

A further concern, expressed in a report on Canada's forest industry by the Canadian Pulp and Paper Association in May, 1981, is that we may be facing a loss of fibre content in the industry due to a variety of reforestation and logging practices. Should this potential loss be even slightly exacerbated by acid rain, a severe blow may be dealt to the Canadian economy. Should, for example, a .5% reduction in forest productivity occur in Canada, we would be facing a $57.5 million loss in our balance of payments, based on the 1980 figures quoted above. This would in turn have substantial impacts on the employment sector.

I have appended a recent report prepared for Ray Robinson, Assistant Deputy Minister of the Environmental Protection Service, Environment Canada, by Dr. Ray Brouzes of Domtar Inc., which outlines in some detail current research on the impacts acid precipitation may have on forests.

IV CONCERNS OF THE COALITION

Over 80% of Ontarians, 50% of Quebec residents, and similar numbers of residents of the rest of Eastern Canada are aware of acid rain and the damage it causes. Awareness is growing in the Prairies. Significant percentages of these groups are also aware that much of the acid fallout in Eastern Canada originates in the United States.

The Directors and staff of the Canadian Coalition on Acid Rain are convinced that, should emissions originating in the U.S. not be significantly reduced in the years to come, the friendly and co-operative relations that we in Canada enjoy with you, our American neighbours, may be significantly damaged, to the detriment of all of us.

The affiliate groups of this Coalition, whose members total over 1,250,000 Canadians (see attached list of members), are seriously concerned at reports emanating from the United States of activities which seem to contradict the interest noted by President Reagan and Interior Secretary Watt in studying and controlling acid precipitation. These activities include:

a. A $100 million cut-back in the budget of the United States Environmental Protection Agency.

b. The Clean Air Act amendments proposed by Representative Broyhill of North Carolina. Mr. Broyhill's amendments seem particularly directed at relaxing the primary health standard for air pollutants, which of course would have a significant effect on permitted emission levels. (I must say that we were heartened by Senator Stafford's recent words to the American Public Health Association to the effect that "removing health from the Clean Air Act would be like removing taxes from the Internal Revenue Code." The Coalition fervently hopes that the concern shown by yourself and by Senator Stafford in maintaining the integrity of the Clean Air Act is shared by the majority of the other members of your Committee.)

c. Approval by the EPA of relaxation of emission limits for sulphur dioxide for 9 coal-fired power plants in Illinois, Michigan, Missouri, Ohio and West Virginia, and pending relaxations for 18 coal-fired power plants in Illinois, Indiana, Michigan, Ohio, Tennessee, and West Virginia.

d. The abolition of the Office of Environmental Affairs of the U.S. Department of Agriculture. A number of officials of this Office were involved in the Working Group set up under the U.S.-Canada Memorandum of Intent dealing with impact assessment.

e. Press reports of a letter written by Representative Dingle of Michigan to President Reagan urging speedy re-authorization of the U.S. Clean Air Act. This would make it most difficult for an orderly and detailed presentation of the Canadian case in the months to come.

f. The giving over of lead responsibility for development of the Administration's policy on acid deposition to James McAvoy, former Ohio EPA Administrator, who has in the past taken strong positions on the need to defer Federal action on acid precipitation until the scientific case is solidly established.

g. Recent proposals by the Environmental Protection Agency to revoke secondary air pollution standards, which would eliminate the Federal authority to limit interstate and international pollution resulting in acid rain. These proposals apparently also include relaxations in pollution standards for new coal-fired power plants and smelters, and further reductions in auto exhaust emission standards.

Much of the above contradicts the intention expressed in the U.S.-Canada Memorandum of Intent that the Government of Canada and the Government of the United States of America, prior to developing a bi-lateral Air Quality Agreement, "(will) take interim actions available under current authority to combat trans-boundary air pollution." Should activities and reports similar to those above continue to occur, relations between Canada and the U.S. will certainly deteriorate, and this deterioration will affect a broad range of bi-lateral issues which are of significance to both countries.

This Coalition is nevertheless convinced, that a great deal of goodwill exists between the citizens of Canada and the United States, and that our American friends would not wish this problem to affect our long-standing friendship. As we see it, the problem regarding acid rain in the United States is in large part one of ignorance on the part of many people that the phenomenon exists, let alone that there is a trans-boundary component to the problem.

Therefore, we ask you, Senator, to help us ensure that all members of the U.S. Senate Environment and Public Works Committee share our serious concern on this issue. We in particular look forward to welcoming members of the Committee to Canada in August, in order that they may see at first hand the affected areas, and talk with representatives of Coalition groups and government officials.

As responsible citizens, none of us must let this most serious problem damage the good relations that Canada and the United States have enjoyed for many years.

UNITED STATES — CANADA
MEMORANDUM OF INTENT
ON
TRANSBOUNDARY AIR POLLUTION

INTERIM REPORT
FEBRUARY 1981

[The following has been excerpted from this document. The entire document has been retained in the committee files.]

I. INTRODUCTION

A. Terms of Reference

This Interim Report has been prepared in accordance with the terms of reference contained in the Annex to the Memorandum of Intent between the Governments of the United States and Canada, concerning Transboundary Air Pollution (MOI), signed August 5, 1980, in Washington, D.C. Specifically, the Annex to the MOI instructs Work Group 3A to:

A. Prepare various strategy packages for the Coordinating Committee designed to achieve proposed emission reductions;

B. Coordinate with other Work Groups to increase the effectiveness of these packages;

C. Identify monitoring requirements for the implementation of any tentatively agreed-upon emission-reduction strategy for each country;

D. Propose additional means to further coordinate the air quality programs of the two countries; and

E. Prepare proposals relating to actions each Government would need to take to implement the various strategy options.

The objective of performing these tasks is to enable Work Group 3A to "identify, assess and propose options for the 'Control' element of an agreement on transboundary air pollution". See Appendix A for the terms of reference given to other Work Groups.

This report has been prepared on a bilateral basis by United States and Canadian members of Work Group 3A. It gives an overview of

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transboundary air pollution including acid deposition in terms of its causes and effects. The report presents:

- An overview of the acid deposition phenomenon;
- A summary of three larger interim reports addressing effects, atmospheric transport, and emissions;
- The groundwork for preparing strategy packages and a listing of ongoing bilateral coordination activities; and
- Recommendations for additional study by the Work Groups and elaboration on uncertainties and data gaps identified in the reports.

These interim reports are the products of Phase I of a four phase process. They, therefore, contain some information and analyses that should be considered preliminary in nature.

A number of effects, concerns and relationships of potential importance in assessing strategies to deal with the acid deposition phenomenon are identified. Quantitative analyses have been performed on some of these issues during Phase I. Further quantitative analyses and assessments will be performed during Phase II. We believe that these Interim Reports accurately reflect the state of knowledge as of January 1981, on the issues considered; but any portion of these reports is subject to modification and refinement as further advances in scientific understanding or the results of ongoing assessment studies become available.

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B. Overview of Work Group Activities

The MOI and Annex require the submission of this Interim Report by January 15, 1981, and a final report by January 1982. Formal negotiations are to commence by June 1, 1981. Additionally, the Chairmen of Work Group 3A have requested all Work Groups to submit an interim report by May 15, 1981 to facilitate the initial negotiations. These milestones made it desirable to break the work activities into four separate phases. These are:

Phase I	- September 10, 1980 - January 15, 1981
Phase II	- January 15, 1981 - May 15, 1981
Phase III	- May 15, 1981 - January 29, 1982
Phase IV	- Post January 1982

The principal objective of Phase I is to allow each Work Group an opportunity to develop its required analysis procedures, identify and assess requisite data bases, and apply these analysis procedures in an initial effort to fulfill their terms of reference. Such activities should prepare each Work Group for extensive interaction with the other Work Groups by the end of Phase I.

The principal objective of Phase II is to provide the Coordinating Committee with the best available information on the emission sources of, atmospheric transport relationships for and likely long-term effects of transboundary acid deposition to enable constructive, useful negotiations to commence at the end of Phase II. While some aspects of the assessments to provide this information will be incomplete and tentative in nature, they will, nonetheless, be the most reliable statements of current knowledge about likely future consequences of transboundary acid deposition

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under a plausible range of future conditions. These analyses will assess the probable reduction in acid deposition required to protect identified sensitive areas affected by transboundary air pollution, and analyze the effectiveness and cost of the particular emission reduction measures selected to achieve the deposition reductions.

The principal objective for Phase III is to refine and expand the information provided to the Coordinating Committee at the end of Phase II. While the Phase II analysis will be specific to acid deposition, the Phase III analysis will include additional transboundary air pollution issues that are likely to be considered in the coming negotiations.

Analysis efforts during Phase III will be initiated by Work Group 3A under appropriate guidance from the Coordinating Committee. Strategy packages will be designed to reduce transboundary air pollution to selected levels. The other Work Groups will analyze the probable results of implementing these packages. The integrated Phase III report should provide the Coordinating Committee with substantially all the available technical information and analysis relevant to closing negotiations on a bilateral, transboundary air pollution agreement.

The principle objective for Phase IV is to provide continuing technical support to the Coordinating Committee as required to clarify remaining issues. No formal work program can be contemplated for this phase until after the submission of the Phase III report.

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II. EXECUTIVE SUMMARY

A. Overview of Transboundary Air Pollution

Transboundary air pollution covers issues ranging from (1) local situations where emissions from an identified facility on one side of the border can adversely affect human health or welfare on the other side of the border within a few tens of kilometers from its origin, to (2) mesoscale (intermediate) situations where one or several sources or an urban area in one country can produce discernible adverse effects in the other country up to many tens of kilometers distant, up to (3) regional and long range transport situations where many sources in one or both countries can in combination produce a regional air pollution problem that crosses the border, for example acid deposition or regional haze. Phase I and II Work Group activities are aimed at elaborating on the nature and extent of the acid deposition problem, which can result from one or more of these three scales of transport. Phase III and subsequent work will in addition address other additional transboundary air pollution issues of interest in the negotiations.

The activities of the Work Groups fall under one of two objectives. The first is to establish a mutual understanding of the causes and effects of acid deposition and the second is to describe and analyze a number of options to deal with the problem.

B. Acid Deposition

In Scandanavia and Europe, transboundary air pollution in the form of acid deposition has caused acidification of thousands of lakes resulting in reductions and losses of fish populations and other adverse impacts.

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Although not exactly comparable to North America, this experience provides insight as to how significant the problem can become and the factors that influence it.

Our knowledge of acid deposition is not complete. There are some general areas where we do not as yet have an adequate understanding. Several of these are noted in Chapter V of this report. Other areas for further study are listed in the Work Group work plans. However, significant conclusive and indicative information about acid deposition has been compiled in the Work Group Interim Reports. This is summarized in the following statements:

Effects

- there are several examples where dramatic changes in water quality believed to be directly attributable to acid deposition have occurred;
- acid deposition can and has severely altered lake and stream ecosystems, depleting and eventually extinguishing fish and other aquatic life;
- acid deposition may contribute to accelerated leaching of minerals and nutrients in some forest soils;
- long term growth of forests in acid sensitive regions may be adversely affected by acid deposition among other factors;
- some crops have been damaged by artificial exposure to highly acidic deposition under experimental conditions;
- the water and soils over extensive areas in North America are susceptible to acidification;

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- stone buildings, monuments and other building materials are eroded by a number of pollutants including acid rain;
- over the long term some drinking water supplies may be contaminated by. toxic metals leached from the soil by acid deposition; however no adverse health impacts have been established to date; and,
- nitrogen compounds affect the acidity of precipitation, but their contribution to damages is uncertain, and is undergoing further analysis.

Transport

- models are useful tools in assessing atmospheric transport, transformation, and deposition of acidifying pollutants;
- long term, long range modelling results are being experimentally confirmed, but only partial validation is possible with existing data;
- short term, local models are well established and sufficiently reliable for regulatory use;
- the major precursors of acid deposition are the oxides of sulphur and nitrogen; the main cations and anions in acidic precipitation are hydrogen and ammonium, and sulphate and nitrate, respectively;
- pollutants, particularly acid precursors, are known to travel for distances of up to thousands of miles through the atmosphere, and thus, in North America, they frequently cross political boundaries;
- nearby emissions contribute more to deposition in a recepter area than the emissions from a similar distant source, but in many situations the total contribution of all distant emissions may exceed the contribution from nearby areas;

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- portions of eastern Canada and the northeastern United States are receiving wet acid deposition which is as severe as that in other severely affected areas of the world (e.g. Scandinavia); and,
- in eastern North America dry deposition of sulphur particularly as SO_2, is thought to be as great as wet deposition; the implication for acidification is not yet fully understood, however, it is cause for concern;

Emissions

- the major emitting source of SO_2 in the U.S. is the existing thermal power generation sector and in Canada is the non-ferrous smelting sector;
- the major emitting sectors of NO_x in both Canada and the U.S. are the transportation sector, the industrial fuel combustion sector, and the thermal power generation sector;
- current commerically available NO_x control technologies on stationary sources have limited effectiveness, however improved NO_x controls are being actively developed;
- control technology is available to reduce significantly SO_2 emissions from existing thermal power plants and analysis is underway to determine the most cost-effective application of this technology;
- process and control technology is available to reduce significantly SO_2 emissions from existing non-ferrous smelters and analysis is underway to determine the most appropriate application of this technology; and,

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alternative control strategies including: changing to lower sulphur coals, coal washing, flue gas scrubbing, application of advanced nitrogen oxide control techniques, and other emerging technologies. Canadian analyses are focussing on alternative abatement options for the non-ferrous smelting and thermal power sectors. They are assessing the emission reductions which would result from the application of specific technologies and/or process changes and the social and economic consequences of these changes.

Both countries are especially interested in identifying feasible abatement strategies that will being the problem under control before more harm occurs.

Additionally, the U.S. has taken important steps to limit emission increases from new sources by adopting, under current authorities, strict control requirements for these sources. In 1979, EPA promulgated a revised New Source Performance Standard for new coal-fired power plants. This standard is significantly more stringent than applicable emission limits for most existing power plants. Existing power plants on average emit more than 80 pounds of sulphur dioxide for every ton of coal they burn. The new plants covered by the revised standard will produce on average only 12 pounds of sulphur dioxide for each ton of coal burned. Depending upon retirement schedules for existing plants, sulphur emissions will begin to decline after the year 2000 even with a high level of economic growth.

In the U.S. new large industrial boilers are also subject to New Source Performance Standards. These standards are in the process of being revised; this activity may result in the application of control requirements to smaller boilers as well. Automobiles, the major source of NO_x, are also subject to regulation under the U.S. Clean Air Act.

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- current national emissions of SO_2 and NO_x in both Canada and the U.S. are not expected to decrease significantly over the next two decades under current control requirements.

This summary of what is known about acid deposition indicates that the problem is genuine and serious. Damage to the environment in both countries has been documented. Acid deposition is a problem which, if it is allowed to go unchecked, could result in substantial economic and social costs. Research must continue in order to develop a clearer understanding of the acid deposition problem. As a practical matter, the best way to reduce acid deposition effects is to reduce emissions of pollutants that cause the problem. To this end, interim actions could be sought in the near term. Short-term mitigating measures also could be considered.

Efforts under air pollution control legislation in both countries and the commitment of some industries to implement control requirements have resulted in noticeable achievements in certain areas. However, most existing air pollution legislation was designed to address the local impacts of air pollution. Although this legislation can be useful in addressing the phenomenon of long range transport of air pollutants and acid deposition, new legislation will likely be required to fully and expeditiously address this problem.

Before the MOI was signed, both countries had initiated analyses of the economic implications of possible control measures to provide a better basis for any new domestic and international policy decisions proposed to reduce deposition. The U.S. analyses are determining the abatement costs likely to be incurred by new and existing industrial combustion sources for

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Recent Canadian reviews of emission limits for existing major sources have recognized the significance of the long range transport of air pollutants, particularly its contribution to acid deposition. The National Energy Program announced by the Canadian Federal Government in November 1980 recognized the importance of making conversions of oil fired power plants to coal environmentally acceptable. Federal funding for each conversion has been made conditional on this principle.

In Ontario, the Provincial Government has invoked a regulation to control emissions from the INCO (International Nickel Co. Ltd.) facility at Sudbury, Ontario. The required reduction by 1983 to 1950 tons per day of sulphur dioxide represents a 70 per cent reduction in emissions over the levels produced in the late 1960's. A Canada/Ontario Task Force, with the cooperation of INCO, will report by September 1981 on options to reduce emissions to the lowest possible level.

The Provincial Government is also examining where further investment in abatement measures can best be retrofitted to existing power generating facilities of Ontario Hydro. Ontario Hydro currently uses washed coal (no specific gravity separation) in all its generating stations and employs low sulphur fuels in environmentally sensitive areas. The Ontario Government expects to announce specific proposals for Ontario Hydro early in 1981 on its emission control program, which will specify limitations and reductions of both SO_2 and NO_x to be accomplished in 1990.

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C. Summary of Work Group Interim Reports

The following summary statements have been taken from the Work Group Interim Reports.

Impact Assessment Work Group (WG-1)

In this first phase of activities under the MOI, the Impact Assessment Work Group has concentrated its resources on identifying the key physical and biological impacts resulting from pollution associated with transboundary air movement. In the Interim Report the acid precipitation component has been emphasized but other important problems, such as oxidants, are identified where there is presently a well documented concern. Other aspects will be dealt with in the second phase.

Acid deposition is currently being observed in most of eastern North America. Within this half-continent are large areas in which the surface soil material and bedrock types have little buffering capacity for acid inputs and are identified as "potentially sensitive". These areas include some of the most unique, unspoiled and biologically productive environments in North America. The potential is high for environmental degradation from the deposition of acid and other pollutants.

During atmospheric transport of sulphur oxides (SO_x) and nitrogen oxides (NO_x) in large scale air mass movements, conversion to their acid components takes place. Measurements of the present level of chemical constituents in precipitation show that significant portions of Ontario and

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Quebec and most north-central and north-eastern states receive annually about 40 times more acid than normal.

This excessive loading is deposited in precipitation as wet fallout and in dry fallout as dust particles and in gaseous forms. Like acid precipitation, ozone is a secondary pollutant, not being emitted directly, but formed in the atmosphere in the presence of sunlight after chemical transformations of nitrogen dioxide and reactive hydrocarbons.

Terrestrial Effects

Ozone damage to vegetation, including reductions in yield for many crop species, has been well documeted in the eastern U.S. and Ontario. These crops include tobacco, white beans, soybeans, corn, potatoes, grapes, onion, cucumber, celery, pumpkin, squash and radish. At ambient concentrations of .05 to .10 ppm during continuous or intermittent exposure periods, loss of plant tissue may approach 15-30% and yield losses of 5-10% may occur for the most susceptible crops. Direct effects of acid precipitation, especially on crops for which the foliage is valued, have also been established under experimental conditions. Other potential impacts include: (1) damage to protective surface structures such as cuticle; (2) interference with normal functions of guard cells; (3) poisoning of plant cells after diffusion of acidic substances through stomata or cuticle; (4) disturbance of normal metabolism or growth processes without necrosis of plant cells; (5) alteration of leaf and root-exudation processes; (6) interference with reproduction processes, and (7) synergistic interaction with other environmental stress factors.

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An increase in soil acidity can be detrimental to the chemical availability of several essential macro-nutrients and over decades a net loss of cations, (Ca and Mg) important for plant growth, from poorly buffered sites can be expected. Areas with soils of low pH are characterized as having low base exchange conditions. In this situation, any further loss of cations is considered significant, however small that loss may be. Much of eastern Canada's forest industry is founded on these low pH soils. The general restriction of commercial forest production to "less productive" sites, coupled with new harvesting technology (where more of the tree is removed from the site, reducing the availability of nutrients for recycling) and the tradition of not applying lime may increase the vulnerability of long term forest growth to acid precipitation.

An increase in soil acidity can also lead to mobilization of other elements (Al, Mn, Fe) sometimes in quantities toxic to terrestrial plants and to aquatic ecosystems. In fact, some studies have indicated that mass mortalities of fish observed during transient episodes of acidification in the spring are most likely a result of elevated levels of inorganic aluminum mobilized from the soils by strong acids present in snowmelt water.

The terrestrial system's influence on the acid component of precipitation also has important implications for the aquatic ecosystem. The results presented in this report on the mobility of nitrate and ammonium ions, have shown that most of the nitrogen added to the watershed is retained by growing plants. However, following a period of sulphate saturation in soils, most of the sulphur passes through to the aquatic

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system. Thus, it appears that control of sulphate deposition would be more effective in reducing the rate of acidification of surface waters than control of nitrogen inputs.

Aquatic Effects

The impacts of acid deposition on water quality and the aquatic ecosystem is better quantified and understood than for terrestrial ecosystems. There are a number of examples where dramatic changes in water quality believed to be directly attributable to acid precipitation have occurred. In Nova Scotia comparisons of recent data with results from the mid 1950's show decreases in pH and concurrent increases in excess sulphate loads. At present there are 9 rivers in this province with a pH of 4.7 which no longer support salmon or trout reproduction; 11 rivers are in the pH range 4.7-5.0 where some juvenile salmon mortality is probably occuring; and 7 rivers are in the pH range 5.1-5.3 which is considered borderline for Atlantic salmon. If current acid loadings continue, it appears probable that more of the inland and Atlantic salmon fisheries in Canada will be lost.

A similar 17-year trend toward acidification of some headwater streams has been observed in New Jersey. As well, high elevation lakes in the Adirondacks have shown a marked pH decline over a 40 year period. This is one of the most sensitive lake districts in the eastern United States. A recent inventory has indicated that at least 180 former brook trout ponds will no longer support trout because of acidification.

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A summary of several Canadian lake studies supports the conclusion that acidic precipitation has reduced the alkalinity of surface water in many lakes, thus increasing their vulnerability to continued acid deposition. Many of the affected lakes are not technically acidified (in the sense of depressed pH), but the long-term biological consequences of the altered water chemistry are unknown at this time. Although naturally acid lakes do occur, a significant number of seriously acidified lakes appear to be a recent response of low alkalinity systems to the continuing addition of hydrogen and sulfate ions.

Concurrent with negative impacts on the fishery, there have been changes in other components of the aquatic ecosystem. Acidification results in changes in the make up, size and metabolism of plankton communities. These alterations hold important implications for other organisms higher in the food chain.

Many species of frogs, toads and salamanders breed in temporary pools which are susceptible to pH depression due to the rapid flushing of accumulated acid during spring snowmelt. Field surveys in North America and Europe have documented the sensitivity of amphibians to depressed pH and the decreases in their number, especially, those inhabiting temporary pools. The danger that they may become locally extinct and their importance in the foodchain hold important implications for other wildlife.

Health Effects

Although available information gives little cause for concern over direct health affects from acid deposition, there are at least two indirect effects of concern; (1) contamination of edible fish by toxic materials,

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principally mercury and (2) leaching and corrosion of watersheds and water storage and distribution systems, leading to elevated levels of toxic elements in drinking water supplies.

Although the mechanisms are not fully understood, available data indicate that fish in poorly buffered lakes contain elevated mercury levels, some in excess of Canadian and United States action levels (0.5 mg/kg and 1.0 mg/kg respectively). Continued consumption of fish containing mercury in excess of these action levels can lead to brain damage and neurological disorders. No clear evidence exists, however, that such effects have resulted as a direct result of acidic precipitation.

A number of drinking water supplies have become contaminated with metals as a result of acidic deposition, but no clear evidence of health effects from drinking these contaminated waters was reported. The elements most frequently detected were lead, cadmium, copper, and zinc. In one Pennsylvania county 16 percent of cistern waters contained lead in excess of the United States and Canadian drinking water standards (50mg/l). Populations at high risk include those obtaining drinking water from poorly buffered lakes and streams (or eating fish from such areas) and those using acidified groundwater or cisterns as a source of drinking water.

Visibility Effects

Effects of transboundary air pollution on visibility are related to air quality, not to acidic deposition. Acid precursors that can significantly affect visibility are sulphuric acid and various ammonium sulphate aerosols. Available data do not suggest that nitrates

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(predominantly in the vapor phase) play a significant role, but visible brown plumes from NO_2 have been reported at a distance of 100 km from isolated point sources.

A substantial decline in regional summertime visibility in eastern North America between the mid 1950's and mid 1970's has been documented. This change may be associated with changes in the level and distribution of sulphur oxide emissions. As well, a reduction in visibility has been noted in the western U.S.; an area noted for its vistas.

Man Made Structures

Acid deposition, oxidants, gases and particulates contribute to the accelerated degradation of materials. Many metallic construction materials are adversely affected by acid deposition through increased dissolution of protective surface oxides or of the metal itself. Masonry materials containing carbonate, such as limestone or marble, are very susceptible to attack by acid deposition. Plastics, elastomers, and organic paints and coatings are degraded by oxidants and by acid-catalyzed polymer decomposition. Physical, chemical or bacterial actions resulting from available air pollutants can contribute to deterioration and corrosion of these different types of materials.

Possibly the most difficult aspect, when viewed from an international perspective, will be the separation of the effects attributable to local emissions from those associated with transboundary flow.

Loading/Effects Relationships

A number of different approaches have been examined to assist in the task of deriving relationships between parameters of acid loading and system response. These models are all under active development, and in the aquatic sector they have advanced to the point where a preliminary application is possible, although it is important to stress that full validation remains to be achieved.

One model, developed in Sweden, indicates that annual sulphate loadings of less than 15 to 17 kg/ha would be unlikely to degrade "moderately sensitive" lakes. The most sensitive lakes and streams are likely to be on the border line of potential effects at an annual sulphate loading rate greater than 9 to 12 kg/ha.

A second model, developed in Norway, shows that precipitation pH of 4.5 and lakewater sulphate concentrations of 60 µeq/l, are the maximum tolerable for lake waters with 50 µeq Ca/l or more. This in-lake concentration of sulphate converts to a precipitation sulphate concentration of about 40 µeq/l. The predicted reductions in precipitation sulphate concentrations to 40 µeq/l in heavily loaded areas is needed to improve the pH from about 4.2 to about 4.5 to protect moderately sensitive lakes. Highly sensitive lakes and streams may be protected at predicted precipitation levels of sulphate of 21 µeq/l which should result in a pH of about 4.8.

A third model, developed in the U.S., combines the acute physiological effects of hydrogen and aluminum ions on fish in their early life stages with data on pH during flushing events (snowmelt or heavy rain). These data show a pH depression (ΔpH) of 0.7 to 1.0 will cause to be a response of substantial physiological significance. Given this dose/response relationship, a loading threshold may be defined as the episodic sulphate loading which, when subjected to a defined flushing event, leads to the

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minimal biologically significant short-term hydrogen and aluminum ion exposure. This model suggests a sulphate loading of 5 to 7 kg/ha/yr produces a critical surface water response (Δ pH in the range of 0.7 to 1.0) for streams in sensitive areas; a loading threshold of 7 kg SO_4/ha/yr converts to about 21 µeq SO_4/l (assuming 70cm/yr precipitation).

None of the predictions of these models are yet viewed as acceptable targets. All three models would benefit from further refinement, and the Scandanavian models have not been validated using North America data. However, validation of these predictions is likely to produce numbers which fall within the range given by present information.

A number of approaches to mapping terrestrial sensitivity to acid precipitation have been undertaken in the U.S. and Canada. Recent discussions however, have indicated that the assessment of terrestrial sensitivity must consider and distinguish between those aspects of the terrestrial ecosystem which have an effect on forest and agricultural productivity on the one hand and aquatic sensitivity on the other. Further refinement and mapping of the different criteria will be undertaken in Phase II.

In the man-made structure area, several approaches to modelling dose/response relationships have been developed using materials of known composition. However, interpolation of results from test conditions are difficult, largely because of a lack of environmental and meteorological data at the test sites.

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Atmospheric Modelling Work Group (WG-2)

The importance of the atmosphere as a pathway or delivery mechanism for acidic and acidifying substances to regions of sensitive receptors in North America is now well established. Sulphur and nitrogen oxides, the major precursors of acid deposition, are known to be emitted in large quantities in eastern North America, and to be transported through the atmosphere for distances of up to several hundreds or thousands of kilometers. The atmospheric lifetimes of these substances and their reaction products are sufficiently long that approximately two-thirds are deposited back to the North American continent, primarily in the east. The remainder are carried out over the Atlantic Ocean. Because the scale of the transport is so large, county, state, provincial and national boundaries are often transversed, posing problems for and among several jurisdictions.

Acidity is associated with, through atmospheric and ecosystem chemical transformations, both primary and secondary sulphur and nitrogen compounds. As a result, portions of eastern North America (as well as isolated western parts) are being subjected to depositions of sulphur and nitrogen oxides (sulphur dioxide, sulphuric acid, nitrogen dioxide, nitric acid, sulphate and nitrate compounds) and hydrogen ions (acidity) that are as great as those in other severely impacted areas of the world (e.g. southern Scandinavia). In addition to the well known deposition pathway of acid rain, acidic and acidifying substances are also known to be deposited as dry deposition, that is, by processes not involving precipitation. In the case of sulphur, dry and wet deposition are estimated to be approximately

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equivalent in eastern North America, with dry deposition being relatively more important closer to sources.

National precipitation chemistry monitoring networks in Canada (CANSAP) and the United States (NADP) are beginning to produce comprehensive, reliable data on a continent-wide basis, and long range transport models (LRT) have been able to estimate the order of magnitude of inter-regional transport and deposition for large areas. The next step required in the refinement of the above types of information is to provide improved spatial and temporal resolution, and to link pollution source regions and sensitive receptor areas in a quantitative fashion. Progress is being made in these areas through the improvement of monitoring network coverage and through the efforts being placed in model development and application.

This latter area is the one on which Work Group 2 placed much emphasis during their Phase I work. They were charged with describing the transport of air pollutants from their sources to final deposition, especially deposition in sensitive ecological areas. The main thrust was to describe the development of state-of-the-art, source-receptor relationships based on available model results and measured deposition values from monitoring networks. This exercise is in a preliminary stage, however, within the constraints of Phase I the best available information has been produced, assembled and reviewed to guide transboundary air pollution control strategies in both countries.

Several LRT models for sulphur oxides have been developed in both Canada and the U.S. which are being used for long-range transport studies.

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Only models that met certain criteria, e.g., fully operational, numerically practical, flexible enough to include new data and other such factors, were used. Features of the individual models were reviewed. The emphasis was strongly placed on the application of models applicable to the larger scales. Short and mid range models do exist and can be applied to specific cases of interest as they are identified in the Phase II work.

The LRT models selected for intercomparison had several important features. They used emission and meteorological data, and physical, chemical and empirical parameters to calculate the transport of a given pollutant to a sensitive area. To date the models have been limited to describing sulphur deposition on a monthly or annual basis. Hydrogen and nitrate ion deposition, two important factors in acid rain, have not yet been successfully incorporated in the models. Initial source-receptor relationships for sulphur have been determined using model calculations.

Because the models are to be used to develop and analyze control strategies, a quantitative relationship between pollution emissions and deposition in sensitive areas must be established. To do this, a transfer matrix approach was adopted. Theoretically, by using this method, a change in rate of emissions can be tied to a change in the deposition in a sensitive area. Preliminary transfer matrix results have been presented, but the detailed transfer coefficients within these matrices are subject to future changes, possibly significant, as modeling techniques are refined. Although preliminary in nature, the needed framework to produce more accurate transfer matrices during Phase II has been set up.

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In order to check the accuracy of models, field measurements of deposition from the existing monitoring networks in both countries are required. At present, wet deposition/acid rain measurements are being made regularly in several monitoring networks in both countries. These have been used for evaluation of models selected by Work Group 2 during Plase I. However, dry deposition, an important factor in ecological effects, can not yet be measured on a routine basis. Existing deposition data will be used to evaluate more thoroughly the selected models throughout Phase II.

Knowledge of the atmospheric mechanisms by which SO_2 converts to SO_4 is incomplete. This can lead to uncertainty in the SO_4 deposition reductions that would be achieved as a result of possible SO_2 emission control efforts.

Although the currently available long-range transport models do have restrictions on their usefulness, they are indispensible for estimating source-receptor relationships. Their further development, evaluation and intercomparison will be a major activity of Work Group 2 in Phase II.

Emissions, Costs and Engineering Work Group (WG-3B)

Extensive efforts have been expended in both the United States and Canada to establish emission data bases for sources of sulphur and nitrogen oxides. Table 1 presents the current emissions of sulphur and nitrogen oxides for the major source categories for each country.

Two-thirds of all United States sulphur dioxide emissions come from electrical generating plants, while other fossil fuel burning installations and industrial processing account for nearly equal shares of remaining United States sulphur dioxide emissions. A large majority of these

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TABLE 1

CURRENT EMISSIONS IN THE U.S. AND CANADA (10^6 Tons)

	U.S.A. (1980 Estimated)		CANADA 1979*		TOTAL	
	NO_x	SO_x	NO_x	SO_x	NO_x	SO_x
Utilities	6.2	19.5	0.3	0.8	6.5	20.3
Industrial Boilers/ Process Heaters/ Residential/ Commercial	7.1	7.3	0.6	1.1	7.7	8.4
Non-Ferrous Smelters	0.0	2.0	0.0	2.2	0.0	4.2
Transportation	9.0	.9	1.1	0.1	10.1	1.0
Other	–	–	0.2	1.1	0.2	1.1
TOTAL	22.3	29.7	2.2	5.3	24.5	35.0

* Inco, Sudbury at 1980 emission rate.

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emission sources are in the mid-west and northeast United States where they can affect potentially sensitive environmental receptors in the United States and Canada through atmospheric transport, and deposition of acidic compounds. The highest density of sulphur dioxide emissions is in the upper Ohio Valley (eastern Ohio, northern West Virginia and western Pennsylvania) where a number of large power plants burn high sulphur coal with little control of their sulphur emissions.

Total Canadian sulphur dioxide emissions are about one-fifth those of United States sources, and are concentrated in the non-ferrous smelting sector which accounts for forty-five percent of total sulphur emissions. Power plants account for little more than ten percent, while other combustion sources and other industrial processes nearly equally account for the remaining Canadian sulphur dioxide emissions. Almost half of Canadian emissions come from a small number of non-ferrous smelters. One of these smelters, located in central Ontario, is the largest single sulphur dioxide emission source in North America, and is responsible for fully twenty percent of Canada's sulphur dioxide emissions. Three quarters of the total Canadian emissions are east of the Manitoba-Saskatchewan border.

More than forty percent of the nitrogen oxide emissions in the United States come from the transportation sector. Electric utilities account for thirty percent and other combustion sources account for the remainder.

About sixty percent of Canadian nitrogen oxide emissions come from the transportation sector. Electric utilities account for ten percent and other combustion sources for twenty percent. Two-thirds of Canadian emissions are east of the Manitoba-Saskatchewan border.

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Natural NO_x emission rates in eastern North America are currently not well determined. However, indirect evidence can be used to assess the possible relevance of these emissions to acid deposition, as will be done in future Work Group activities.

Projected emissions of sulphur and nitrogen oxides in Canada are shown in Table 2.

Projected emissions of sulphur and nitrogen oxides in the U.S. are presented in Table 3. Projected emissions of sulphur oxides in the region that is believed to contribute most to acid deposition are expected to decline, assuming that strict compliance with current emission limits is attained.

Technology is available to significantly reduce SO_2 emissions from all major SO_2 emitting sectors. Because of their significance, the discussion in this summary is limited to thermal power and non-ferrous smelting.

Control of SO_2 emissions from thermal power plants has become a complex problem with several options available and many factors involved in making the choice among them.

Sulphur oxide emissions can be reduced by several methods:

1) use of naturally occurring low sulphur fuel
2) removal of the sulphur before combustion
3) reaction with an absorbent during combustion
4) flue gas desulphurization.

All are being used to some degree.

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TABLE 2

PROJECTED EMISSIONS OF SO_x AND NO_x IN CANADA (10^6 tons)

	YEAR				
	1980	1985	1990	1995	2000
NO_x TRENDS					
Utility Boiler	0.3	0.4	0.6	0.6	0.7
Industrial, Residential and Commercial Fuel Combustion	0.6	0.6	0.7	0.7	0.7
Non-Ferrous Smelters (Cu/Ni)	-	-	-	-	-
Transportation	1.1	1.3	1.5	1.6	1.8
Other	0.2	0.2	0.2	0.2	0.2
TOTAL	2.2	2.5	3.0	3.1	3.4
SO_x TRENDS					
Utility Boiler	0.8	1.1	1.2	1.3	1.4
Industrial, Residential and Commercial Fuel Combustion	1.1	1.1	1.2	1.2	1.2
Non-Ferrous Smelters (Cu/Ni)	2.2	2.0	2.0	2.0	2.0
Transportation	0.1	0.1	0.1	0.1	0.1
Other	1.1	1.1	1.1	1.1	1.1
TOTAL	5.3	5.4	5.6	5.7	5.8

Source: Data Analysis Division, Air Pollution Control Directorate, Environment Canada

Note: Based on a "status quo" scenario

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TABLE 3

PROJECTED EMISSIONS OF NO_x AND SO_2 IN THE U.S. (10^6 tons)

	YEAR 1980	1985	1990	1995	2000
NO_x TRENDS					
Utility Boiler	6.2	6.8	7.6	8.4	9.2
Industrial Boiler/ Process Heat	6.2	6.5	6.9	7.6	8.4
Non-Ferrous Smelters	0.0	0.0	0.0	0.0	0.0
Residential/Commercial	0.9	0.9	0.8	0.8	0.7
Transportation	9.0	8.3	8.6	9.4	10.2
TOTAL	22.3	22.5	23.9	26.2	28.5
SO_x TRENDS					
Utility Boiler	19.5	17.9	18.6	19.0	18.5
Industrial Boiler/ Process Heat	5.9	5.7	6.8	8.6	10.3
Non-Ferrous Smelters	2.0	0.77	0.60	0.56	0.52
Residential/Commercial	1.4	1.4	1.2	0.9	0.6
Transportation	0.9	0.9	0.9	0.9	0.9
TOTAL	29.7	26.7	28.7	30.0	30.8

Source: These emission estimates based on 1980 trends but projected with % change of models (utility-TRI, industrial ICF; RES/COM-SEAS; Transportation-Anne Arbor); NF Smelters come from an actual unit-by-unit survey.

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The listing in Table 4 is made for process choices at different required levels of emission reduction. It should be noted that these are only approximate and that site-specific conditions could well affect the pollution control option actually chosen.

Several approaches can be used for NO_x control. Low nitrogen fuel is one of these but is not as effective as low sulphur fuel is for SO_2 because more than half of the NO_x comes from the combustion air rather than the fuel. Combustion modification is the most cost effective method. Although it is widely used, it is limited in its effectiveness by practical engineering factors. If flue gas treatment is required, injection of ammonia to reduce, non catalytically, NO_x to nitrogen may be favored. Catalytic reduction with ammonia to reduce NO_x has potential, but is unproven on coal fired power plants. Various wet scrubbing methods have been considered but none seem very promising.

The selection of abatement method depends on the degree of control required, the cost of such control and the site specific characteristics for control. A listing of NO_x control options is contained in Table 5.

The non-ferrous smelting sector is a major source of SO_2 emissions. In eastern Canada, the major non-ferrous smelter sources emitted an estimated 2.2 million tons of SO_2 in 1980 (emissions at full capacity operations are estimated at 3 million tons). Virtually all of the major smelter emissions sources are in the copper-nickel sector. In the eastern United States there are no major non-ferrous smelter sources of SO_2. However, there are major non-ferrous sources of SO_2 in the Western United

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TABLE 4

Removal efficiency level, %	Process
Higher than 90%	1. Double alkali scrubbing 2. Limestone scrubbing with promoters 3. Coal gasification[a] 4. Regenerable scrubbing processes
90%	1. Limestone scrubbing with promoters 2. Limestone scrubbing 3. Double alkali scrubbing
50-90% (high-sulphur coal)	1. Limestone scrubbing 2. Fluidized bed combustion[a] 3. Chemical coal cleaning[a] 4. Low sulphur fuel substitution 5. Limestone Injection Multi-Staged Burner[a]
50-90% (low-sulphur coal)	1. Spray drier process 2. Limestone scrubbing
Below 50%	1. Physical coal cleaning (highly variable effectiveness due to coal properties) 2. Blending with low sulphur coal.

[a] If and when developed

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States (copper sector). No studies have been attempted to determine if there are any conditions under which these western U.S. sources contribute to the acid rain problem in eastern North America.

The process technology in use varies from smelter to smelter. A majority of the smelters use the roaster - reverberatory furnace - converter process which is not amenable to a high degree of SO_2 control, at reasonable cost, due to the weak gas streams produced. Some copper-nickel smelters utilize more modern process technology, and SO_2 emissions are controlled to varying degrees.

The most applicable control technology in use is the production of sulphuric acid in a contact acid plant. Two constraints limit the use of this control technology:

1) weak SO_2 streams (under 4% SO_2) are not suitable for contact acid plants and a number of smelters do not have strong gas streams;
2) markets for sulphuric acid are limited, and it is possible that not all the acid produced could be marketed.

For any major SO_2 control program to succeed it would be necessary to:

1) improve or replace existing process technology (with weak SO_2 streams) with new process technology which produces higher strength SO_2 streams (suitable process technology is available in the majority of the cases);
2) find markets for the sulphuric acid.

Two other problem areas are identified:

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TABLE 5

Removal efficiency level, %	Process
90% or higher	1. Catalytic reduction with more than normal amount of catalyst, preceded by combustion modification (except for coal)
50-80%	1. As above, with a normal amount of catalyst 2. Combustion modification (all types) followed by non-catalytic reduction (ammonia injection without catalyst) 3. Combustion modification alone (for low part of range so as to minimize boiler problems) 4. Low-NO_x burners (under development)
Below 30%	1. Staged combustion[a] 2. Low-NO_x burners[a] 3. Gas recirculation (except for coal)[a]

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[a] Used in combination with others if necessary to achieve the required reduction.

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1) In many smelters, some weak gas streams will remain, even with new process technology, SO_2 emission control technology for weak gas streams in this sector is in the early development stages;

2) The choice of smelter processes to handle concentrates which contain high levels of impurities is limited. This in turn may reduce the level of SO_2 control achievable at smelters handling these concentrates.

These factors are being given careful consideration in analyses conducted by the Canadian Federal and Provincial Governments.

VI CONCLUSIONS

The following general conclusions can be drawn from the results of work carried out thus far by Work Groups 1, 2, 3B and 3A, pursuant to the August 5, 1980 Memorandum of Intent (MOI).

1. The Work Groups have made good progress in meeting the requirements of the MOI for a January 15, 1981 interim report. With continued effort by Work Group members, and the support and provision of resources by Government agencies they can be expected to provide the Coordinating Committee with refined reports, which will facilitate the negotiations scheduled to commence by June 1, 1981.
2. The findings of the Work Groups in these interim reports give further precision to the problem of transboundary air pollution, which motivated the Governments to sign the MOI. They also indicate that a variety of technologies are available to reduce emissions from major emitting sectors. Further work will focus on the identification of Canada/U.S. control strategies for consideration.
3. As envisaged in the MOI, the interim reports are a first step in the preparation of technical and scientific groundwork for negotiation of a cooperative agreement on transboundary air pollution. In view of the importance and urgency of this problem however, they may also assist in formulating the interim actions by both countries called for in the MOI to deal with the problem, pending conclusion of an agreement.

TESTIMONY ON:

Transboundary Pollution

TO:

The Committee on Environment and Public Works

July 1, 1981

by

Paul J. Lioy, Ph.D.

Institute of Environmental Medicine,

New York University Medical Center

The characteristics of atmospheric pollution, for both the gaseous and particulate species, are controlled by the following major factors: the sources of emitted contaminants; the transformation of primary (or precursor) pollutants; the transport of contaminants; and the physical deposition and effects of accumulated pollutants. For the purposes of this forum, the discussion will focus on the transport of pollution and the nature of transboundary problems. It should be remembered throughout, however, that the other factors are affected, either directly or indirectly with the atmospheric meteorological processes.

The scale of movement of atmospheric contaminants is described by four categories:

1. Microscale Transport. The distribution of contaminants in this regime is usually confined to a limited or community wide area (< 6 miles). These situations occur when source accumulation patterns are affected by street canyons, building sites and traffic congestion. Peak levels usually occur when intense atmospheric inversions (high stability) develop. Typical examples of contaminant exposures strongly influenced by micrometeorology are carbon monoxide, lead and volatile organic compounds.

2. Mesoscale Transport. Within this regime, the movement of air is usually associated with processes that occur within a 80 mile radius of the source. Physical and chemical processes that occur in this regime are associated with the dilution and transformation of primary pollutants and the production of secondary products via a number of chemical pathways. This transport regime includes meteorological events such as thunderstorms, sea breezes, urban heat islands, and valley-mountain breezes. Typical examples of sources which contribute to mesoscale processes are reactive urban and industrial plumes. Pollutants of concern within such plumes include the primary pollutants as sulfur dioxide, nitrogen oxides, hydrocarbons, and primary particulate matter and secondary pollutants, such as ozone, nitric acid, sulfuric acid, particulate organic matter and aldehydes.

The particles, which are formed by physical and chemical reaction of primary gas phase pollutants, are usually between 0.1 and 1 µm in diameter in the so-called accumulation size regime. Under many atmospheric conditions, these particles can exist in the atmosphere for days. Field studies have shown that cohesive urban plumes can persist up to 180 miles downwind and produce significant quantities of 0.1 - 1.0 μm sized particles.

3. Synoptic Scale Transport. During the past decade the accumulation and persistance of fine particles, primarily sulfate, as well as ozone and the constituents of acid rain has been found to be associated with migrating high and low pressure systems. The are usually several thousand kilometers (> 1,000 miles) in diameter. Each system is periodic in nature and can last for periods of between three and fifteen days in the Eastern, U.S. It should be noted before the discussion goes further that the meteorological processes associated with high and low pressure systems are different. High pressure systems usually describe the build up and persistence of secondary products from chemical transformations, while low pressure systems are associated with significant wet weather events which can lead to major reductions in atmospheric pollutant burdens. The two types can interact a front between each.

An example of a high pressure system with accumulated pollusion is found in Fig. 1. Individual systems will move across the Eastern U.S. and simultaneously rotate around the center of high pressure. During its movement, a system will spend sufficient time over major source regions and accumulate primary pollutants. Initially, these pollutants will be associated with individual urban and industrial plumes, which, as previously noted, will be transformed in part, into a number of secondary products. For a typical even, with the passage of time, these plumes will eventually merge within the system and uniformly distribute the pollutants over a very wide region.

Acid rain is linked to the occurrence of low pressure systems, although the influence of the deposition of pollutant species will also be associated with thunderstorms, and frontal movement. Presently, due to the complexities of cloud chemistry, it is difficult to differentiate the major pathways, although H_2SO_4, HNO_3 and HCl are major constituents.

A difficulty presently encountered by scientists in the area of synoptic transport is finding the direct links to the emissions from specific sources. This problem appears to revolve around the fact that the conversion processes do not take place at a uniform rate, and at times involve reactions associated with cloud formation and dispersal and the amount of reactive radical species present in the atmosphere. Thus, the reaction rates may at times, be slow.

4. Long Range Transport. The processes involves with this regime involve all of the preceding for mesoscale and synoptic scale situations. However, the duration of these events can exceed 20 days and cover distances in excess of 2,500 miles. Aerosols are more readily transported in these situations than the primary pollutant gases, and have been found to be associated with man-made and natural events. Artic haze, volcanic and wind blown dust are typical examples of such long range transport.

From the foregoing, it is apparent that air pollution can be moved great distances depending upon its physical and chemical forms and the prevalent meteorology. It should also be apparent that the discussion was not limited by various man-made political boundaries, which lead to the essence of this presentation. Pollution control practices for the protection of the health and welfare of the people must be resolved on a pollutant by pollutant basis. In each case, a number of considerations must be weighted, and these may include control of processes not directly under the jurisdiction of one local governmental organization. Thus, the concept of the local Air Quality Control Region may be inappropriate for the many types of modern day pollution episodes. A good example is the persistent photochemical smog which covers a large part of the eastern U.S. in the warmer months. The resolution of transboundary problems must be done by thorough examination of pertinant data for the precursor and secondary pollutants in question. Thus, enabling legislation must be contained in the Clean Air Act to address this issue in a timely and consistent manner. Furthermore, research funds should continue to be provided for a long term program with addresses the scientific issues associated with the production of pollutants that can be moved long distances downwind. It is unreasonable to expect that appropriate answers to major transboundary disputes can be effectively resolved without substantial further research on the controlling chemical and physical processes which affect the pollutant burdens causing population exposures or ecological effects.

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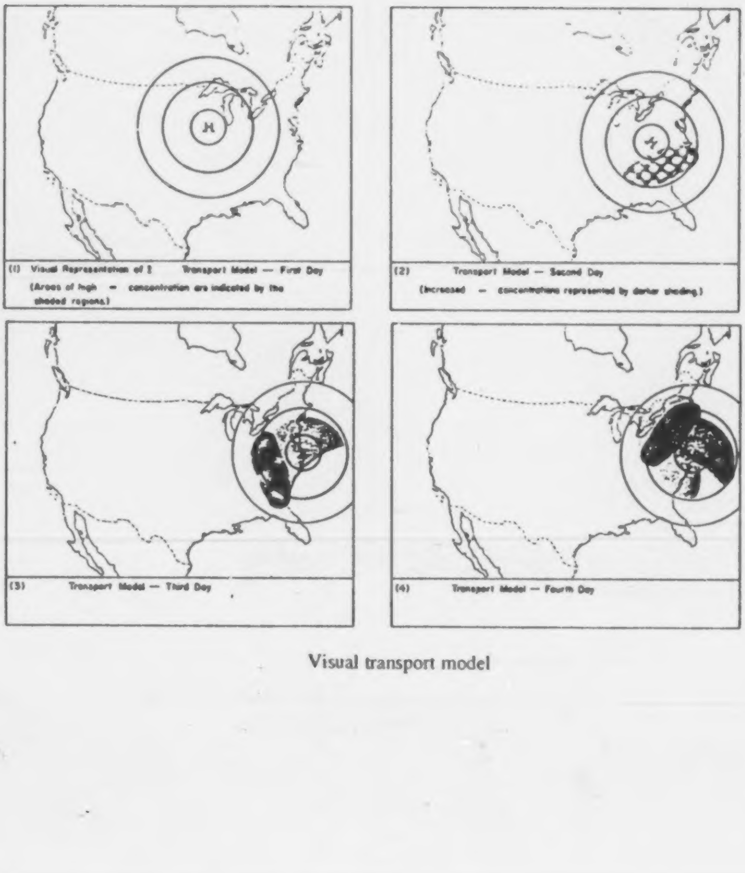
Figure 1.


(1) Visual Representation of I Transport Model — First Day
(Areas of high - concentration are indicated by the shaded regions)
(2) Transport Model — Second Day
(Increased - concentrations represented by darker shading)
(3) Transport Model — Third Day
(4) Transport Model — Fourth Day

Visual transport model

Testimony by Dr. Peter E. Coffey
Administrator of Air Programs
New York Power Pool

To

United States Senate
Committee on Environment and Public Works

Given at Clean Air Act Oversight Hearing
Albany, New York July 1, 1981

My name is Peter E. Coffey. Presently I am Administrator of Air Programs for the New York Power Pool. In my previous position at the New York State Department of Environmental Conservation as chief of the long range transport and chemical reaction section, I also served as coordinator of the New York State Inter Agency Task Force on Acid Precipitation. I have been involved in acid precipitation related research since 1973 and have written a number of technical papers on the subject.

Historical Perspective

The intense concern about acid precipitation in the United States dates from a 1974 article by Cogbill and Likens.(1) This article contained maps of the eastern portion of the United States on which were drawn isopleths (lines of constant value) of precipitation pH for the periods of 1955-56 and 1965-66. These maps showed a dramatic spread westward and southward of precipitation with a pH less than 5.6 for the 10 year period. Other scientific investigators have reviewed these data and have come to different conclusions as to the porported increases suggested by Cogbill and Likens.

The scientific investigations which have been conducted in the intervening years since the 1974 paper have cast some light upon the situation, however the acid precipitation phenomenon is still not well understood.

It is clear that the precipitation in the Northeastern United States and Southeastern Canada is acidic with a yearly average pH of 4.2. The results from extensive precipitation collection networks established since 1974 show that the acidity of the precipitation is caused primarily by sulfuric acid, and nitric acid.

Sources

The sources of the precursors (SO_2 and NOx) which produce strong acids are quite varied. Table 1(1) breaks down the anthropogenic (man made) portions of these emissions in the SURE region by source category and season. The SURE region is appropriate since it covers all states east of the Mississippi River plus Iowa, Minnesota, Missouri, and Louisiana. It also covers the Canadian provinces of Nova Scotia, New Brunswick, Newfoundland, Quebec, Ontario, and Prince Edward Island. It should be noted that the sulfur emissions in the SURE region are almost entirely anthropogenic while the nitric acid emissions have a substantial but unknown biogenic component.

As seen in Table 1 the emissions of these primary pollutants have no strong seasonal variations, however, the average ratio of sulfuric to nitric acid in precipitation changes considerably with season. In the Northeast, on a yearly average basis sulfuric acid produces twice the acidity that nitric acid produces but nitric acid is the dominant acidifier during the winter months. This is the resultant of a strong summertime maximum in sulfuric acid production. The nitric acid component changes very little with the seasons.

Of course the reasons underlying these changing ratios and the variations which are seen from day to day and weather system to weather system lie in the atmospheric chemistry and the meteorology.

The oxidation of sulfur dioxide to a strong acid is believed to be the resultant of homogeneous gas phase reactions and heterogeneous reactions in cloud droplets.

The status of heterogeneous reactions for SO_2 oxidation is very unclear at this time. These reactions require the absorbtion of SO_2 into an aqueous droplet and the subsequent oxidation by a strong oxidizer such as ozone or hydrogen peroxide. Since much of the acidity in precipitation is believed to be the resultant of these heterogeneous reactions it is essential that they be understood if we are to be able to predict the effect of changing emissions on precipitation acidity.

The nitrogen chemistry is more poorly understood than the sulfur chemistry. It is essential that we learn more about this nitrogen oxidation both to understand the production processes for nitric acid and the role the nitrogen oxides play in the production of the radicals and oxidizers which cause the sulfur reactions.

Varying Acidity and Long Term Trends

Perhaps the most disquieting aspect of the Cogbill and Likens papers were the allegations that the precipitation pH was rapidly decreasing over a wide area. This claim has not been substantiated by the scientific community. Mr. Thomas Harr and I published in 1975 an analysis of precipitation pH data collected by the United States Geology [illegible]rvice at eight New York sites and one Pennsylvania site.(3) This data covering the years 1965 to 1973 is shown in figures 1, 2, 3, 4. We concluded that no pH trends were evident. More recently Hansen et al(4) have examined the same data set through 1979 and have reached the same conclusion. I have included the figures from our paper to illustrate the large deviations in precipitation pH which exist from year to year. Yearly variations noted during this period are not due to emission changes but most probably result from the direct and indirect results of climatological variations. Direct climatological variations are changes in solar insulation, temperature, moisture and wind patterns. Indirect changes are variations in such items as increased or decreased materials injected into the atmosphere as wind borne dust due to drought or excessive rain conditions. Indeed the analyses of Semonin(5) and Hansen et al(4) on the Cogbill and Likens paper point out that increased alkaline particulates in the atmosphere due to severe drought in the mid 1950's not decreased acidifying components raised the pH of the precipitation of the era.

Judging from the historical level of national emissions of sulfur and nitrogen oxides as calculated by Land(6) in Figures(5) and (6) I would conclude that the component of acid precipitation caused by pollution has not changed much over at least the last 60 years.

The variability of precipitation pH from year to year and storm to storm pose the question as to just what is the pH of "natural" precipitation. Likens and his coworkers have established in the popular literature a naturally expected pH of 5.6 corresponding to the acidifying effects of dissolved atmospheric carbon dioxide in equilibrium with water droplets. This argument ignores the processes which cause precipitation. All precipitation is initiated by particles either natural or of anthropogenic origins There is no apriori reason that the naturally produced component of these particles should be of neutral pH. Nature is quite capable of making strong acids and bases without help from man. The initially formed droplets or ice crystals, as the case may be, scavenge the atmosphere of gases and other particles which one would also not expect to be of neutral pH.

Precipitation samples collected in remote areas of our globe show a wide range of pH's from the upper 3s to well above 7.(6)(7) Northern Hemisphere averages tend to be around pH 5.(6) Historical data taken from glacial ice cores(8) also indicate that over the past millenia precipitation pH has averaged well under the 5.6 number used by Likens.

In general, I would conclude that the strong acids and alkaline agents both natural and anthropogenic control precipitation pH now and always have, not atmospheric CO_2. Also I believe that the "natural" pH to be expected in a given region has a wide variation which is strongly affected by climatic changes and soil chemistry.

Long Range Transport

There is no doubt that the long range transport of pollution is taking place. However, at this time due to the complex nature of the chemistry and meteorology of the lower troposphere in which this transport occurs the means to quantize it do not exist. The models which must eventually handle the transport questions are still in an embryonic state. Basic parameters such as the dry deposition rate of sulfur and nitrogen compounds can only be quessed at. In short, much more work must be done before the long range transport of acidic pollution can be qualitatively understood.

Ecological Effects

Acid precipitation has not been shown to adversly affect crops, rangelands or forests. However, there does seem to be a problem with lakes and streams in certain susceptable areas such as the Adirondack region of New York. The vulnerability of aquatic systems to acidification is closely tied to local geology. In the Adirondack case the bedrock is dominated by well weathered metamorphic and igneous rock. The soils are shallow, stony, and relatively infertile. Lakes in the region have a low neutralizing ion content with values for calcium, magnesium, and bicarbonate being particularly depressed. In short, the waters are poorly buffered and thus readily susceptable to acidification.

A lake acidification study currently underway in the most heavily impacted area of the Adirondacks confirms that the watershed soil type, depth and hydrology controls lake acidity. At this time more studies and extensive survey work are needed to assess and quantize the damage and potential damage arising from acid precipitation. As we do this, we must not be so myopic as to blame acid precipitation for all the ills of the Adirondack fishery, or at least not do so until other mechanisms which can affect aquatic systems are investigated and evaluated.

These lakes may have been greatly perturbed by man's activities during the past century. Therefore, an evaluation should be made of the following; effect of changing fish stocking policies and rates over the past century; effects of alkalinity released by the numerous forest fires in the first quarter of this century; effects of extensive DDT applications to streams and watersheds in the 1940's and 1950's to control black flies; and the effects due to land use changes in general. Only by investigating and evaluation the impact of all major perturbations on the Adirondack lakes can we set in perspective the effects for which acid precipitation is responsible.

For reference to the condition of the fisheries in the region of the Fourth Fulton Lake (the most heavily impacted area of the Adirondacks) in

1909 I am including excerpts of a letter from Judge Devendorf taken from the State of New York Forest, Fish and Game Commission Annual Reports 1907-1908-1909 Page 357.

> "We have absolutely no fishing in these lakes during the vacation months. It is true there are a few speckled trout caught about the inlets early in the season and some salmon trout. That fishing is all over long before 90 percent of the campers, cottage owners and boarders come to the lakes, and from that time on there is no fishing whatever excepting for small mouthed black bass, which are extremely difficult to catch and do not provide for the average individual any fishing whatever. I am firmly of the opinion that these lakes ought to be stocked by the State with some kind of fish that would be desirable for the many who visit there each year. There are hundreds of thousands of dollars invested along these lakes in hotels, boarding-houses, camps, cottages and their appurtenances and there is plenty of good water. All we lack is the fish. ..."

From the tone of the letter I would conclude that the fishery in that region of the Adirondacks was not very good at a time predating acid precipitation as we know it.

Conclusions

Precipitation in the northeastern United States is acidic, being dominated by sulfuric acid and nitric acid. Although the emissions of the precursors of these acids are almost constant, their deposition fluctuates widely from storm to storm and year to year. These fluctuations are due to complex interactions involving chemistry, meteorology and climatology in a manner which is not understood. Because of the unknown character of these variables it is not presently possible to describe the transport processes.

The initial assertions in the 1970's that precipitation is becoming more acidic has not been substantiated. Acid precipitation as it now exists probably has been around for at least 60 years. Furthermore, the characterization of pH 5.6 as being the "natural" acidity of precipitation is based on an overly simplistic and erroneous assessment of the atmospheric processes which produce precipitation.

The only area of ecological damage from acid precipitation that has been scientifically demonstrated is in certain susceptable aquatic systems. Lakes in New York's Adirondack region appear to be susceptable to acidification damage. However, at this point in time the impact on these lakes due to acid precipitation has not been established. More aquatic research and survey information is needed.

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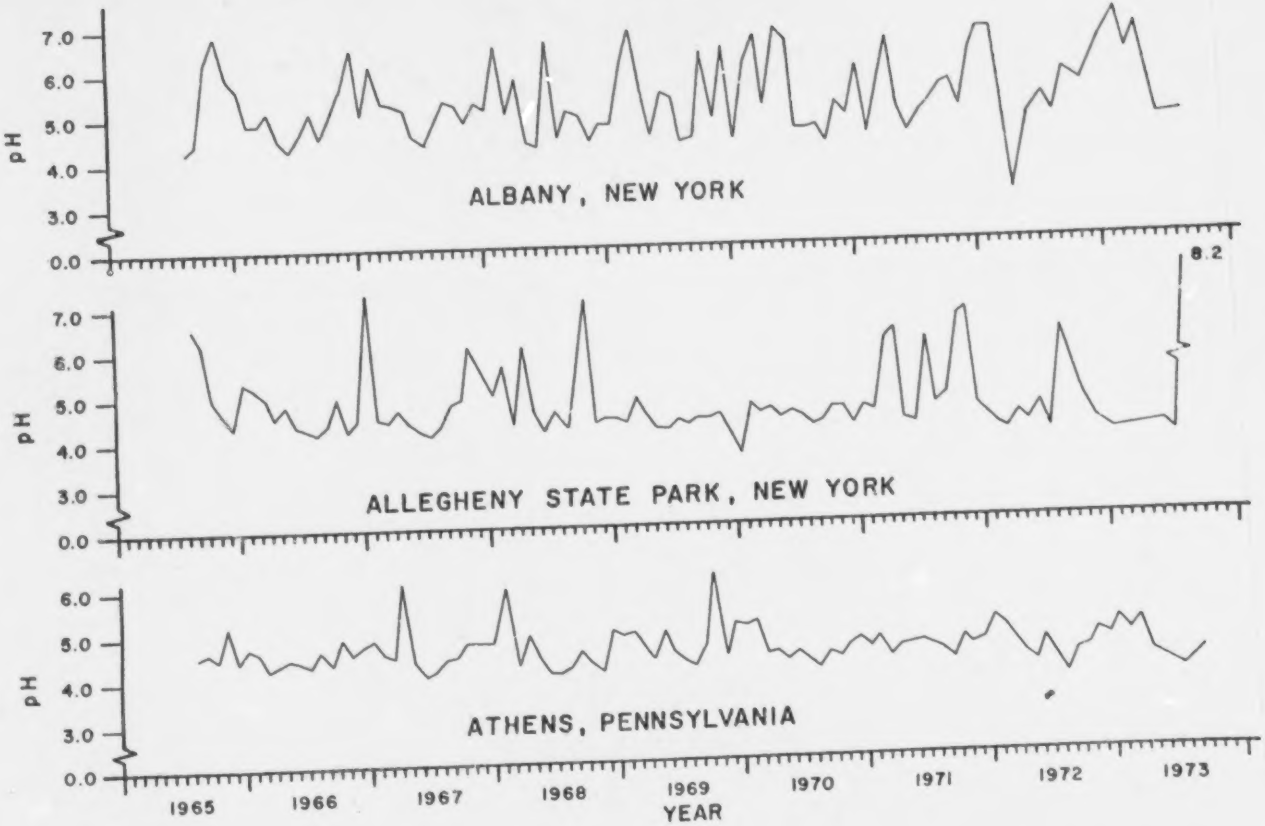
TABLE I AGGREGATED SULFUR DIOXIDE AND NITROGEN OXIDE EMISSIONS WITHIN THE SURE STUDY AREA BY SEASON*
(10^3 tons/day)

	Winter	Spring	Summer	Fall
SO_2				
Total	99.0	86.6	86.8	88.5
Utility	52.5	48.7	52.5	50.1
Industrial	36.5	33.0	31.6	33.5
Commercial	6.7	2.7	0.9	2.7
Residential	2.2	0.7	0.05	0.7
Transportation	1.3	1.5	1.6	1.5
NO_x				
Total	36.6	34.8	36.1	35.4
Utility	11.4	10.6	11.6	10.8
Industrial	7.5	6.5	6.0	6.6
Commercial	2.1	0.8	0.2	0.8
Residential	1.6	0.5	0.0	0.5
Transportation	14.0	16.5	18.2	16.7
Total Emitted Particulate (TEP)				
Total	46.3	44.5	45	45.2
Utility	5.8	5.4	5.7	5.1
Industrial	31.4	33.5	35.1	34.5
Commercial	4.1	1.6	0.4	1.5
Residential	2.0	0.6	0.025	0.6
Transportation	2.9	3.4	3.7	3.4

*From Hidy and Mueller, 1980.

FIGURE I

PRECIPITATION pH



ALBANY, NEW YORK

ALLEGHENY STATE PARK, NEW YORK

ATHENS, PENNSYLVANIA

FIGURE 2

PRECIPITATION pH

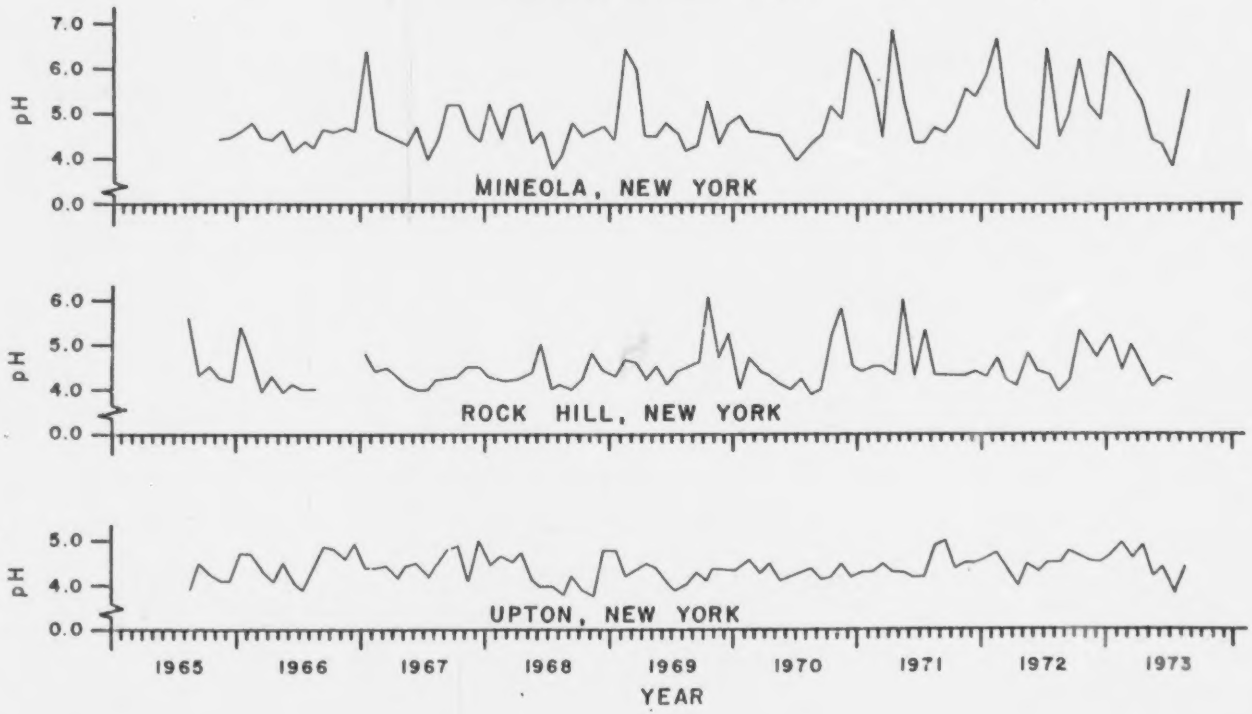


FIGURE 3

PRECIPITATION pH

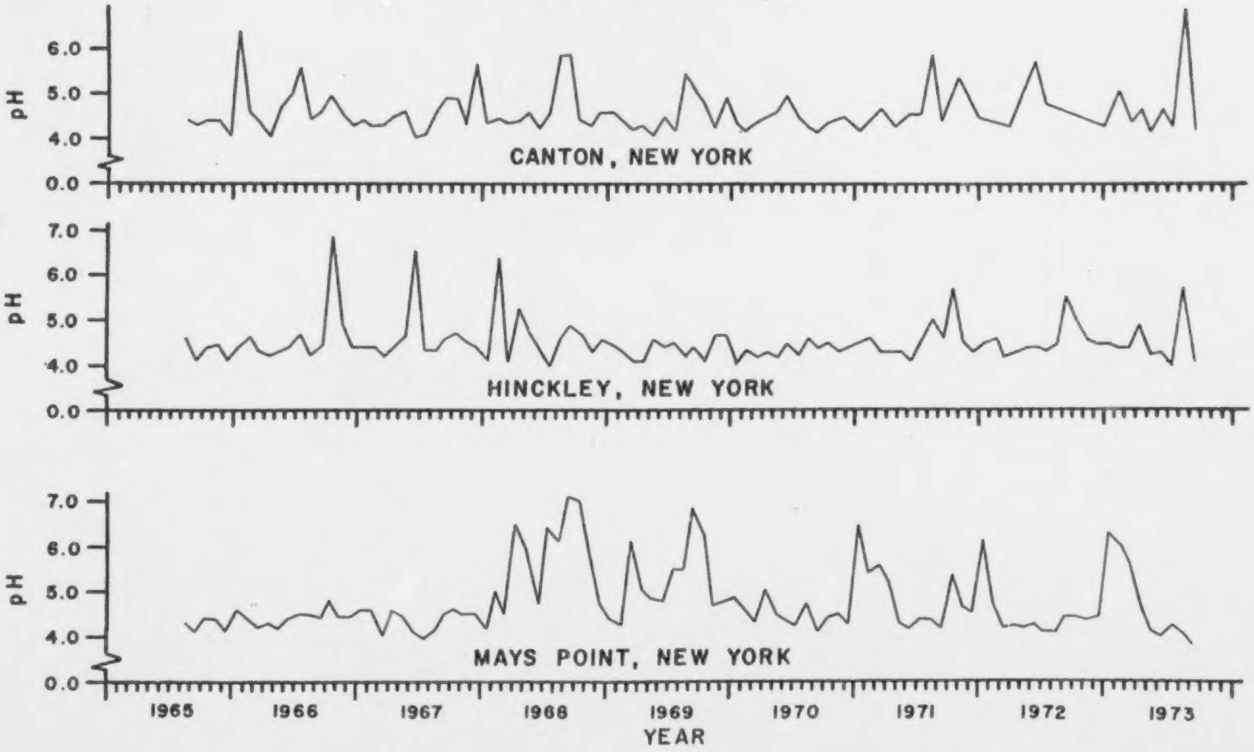
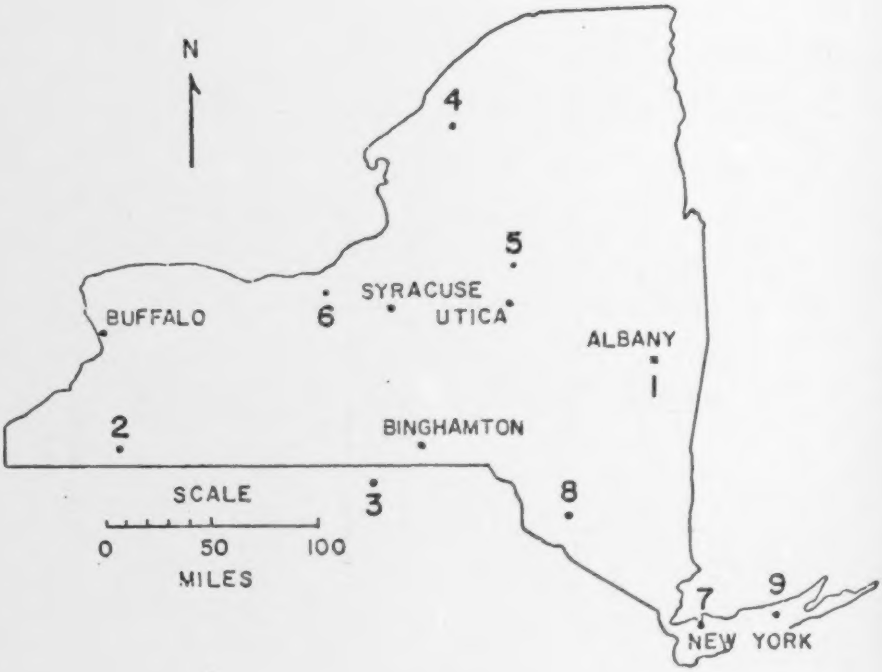


FIGURE 4
LOCATION OF PRECIPITATION pH MONITORING STATIONS

1. Albany, N.Y.
2. Alleghany State Park, N.Y.
3. Athens, Pa.
4. Canton, N.Y.
5. Hinckley, N.Y.
6. Mays Point, N.Y.
7. Mineola, N.Y.
8. Rock Hill, N.Y.
9. Utpon


N
4
5
SYRACUSE
UTICA
6
BUFFALO
ALBANY
1
2
BINGHAMTON
SCALE
3
8
0
50
100
MILES
7
9
NEW YORK

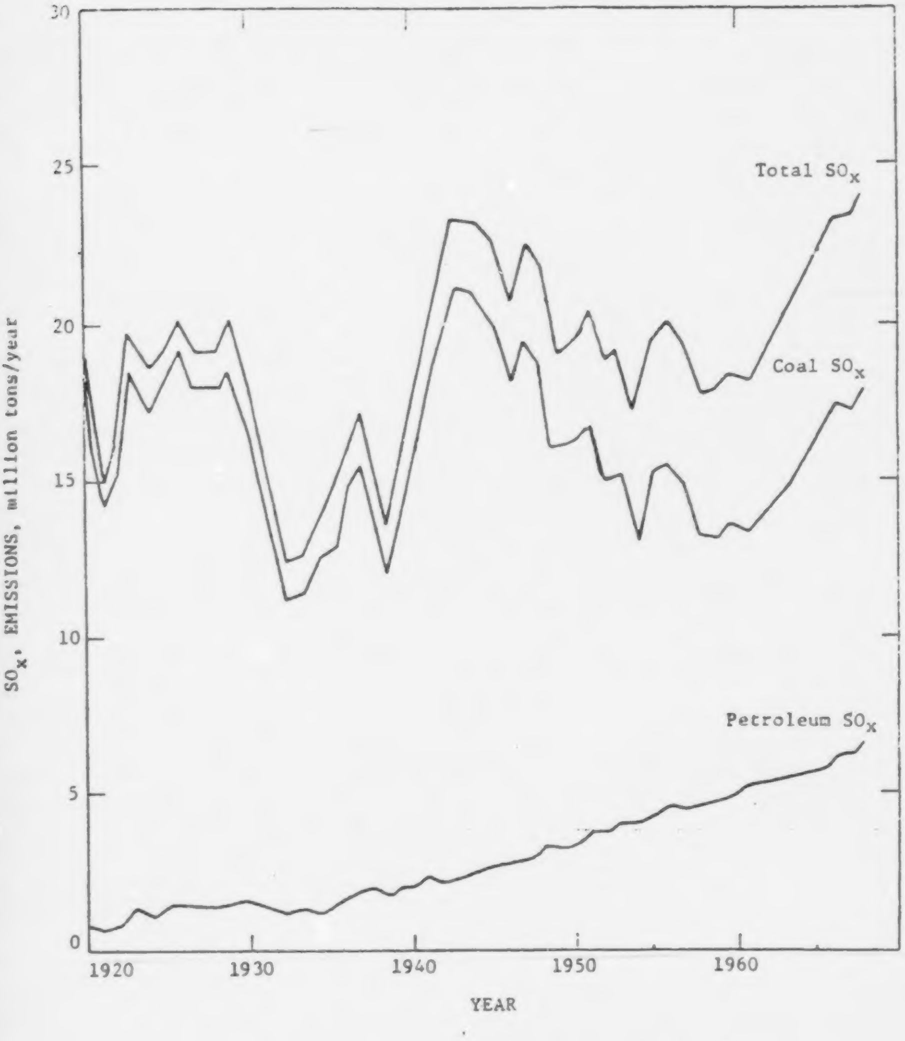


FIGURE 5. SULFUR OXIDES EMISSIONS FROM FOSSIL FUEL COMBUSTION, MILLIONS OF TONS PER YEAR (LAND, 1976)

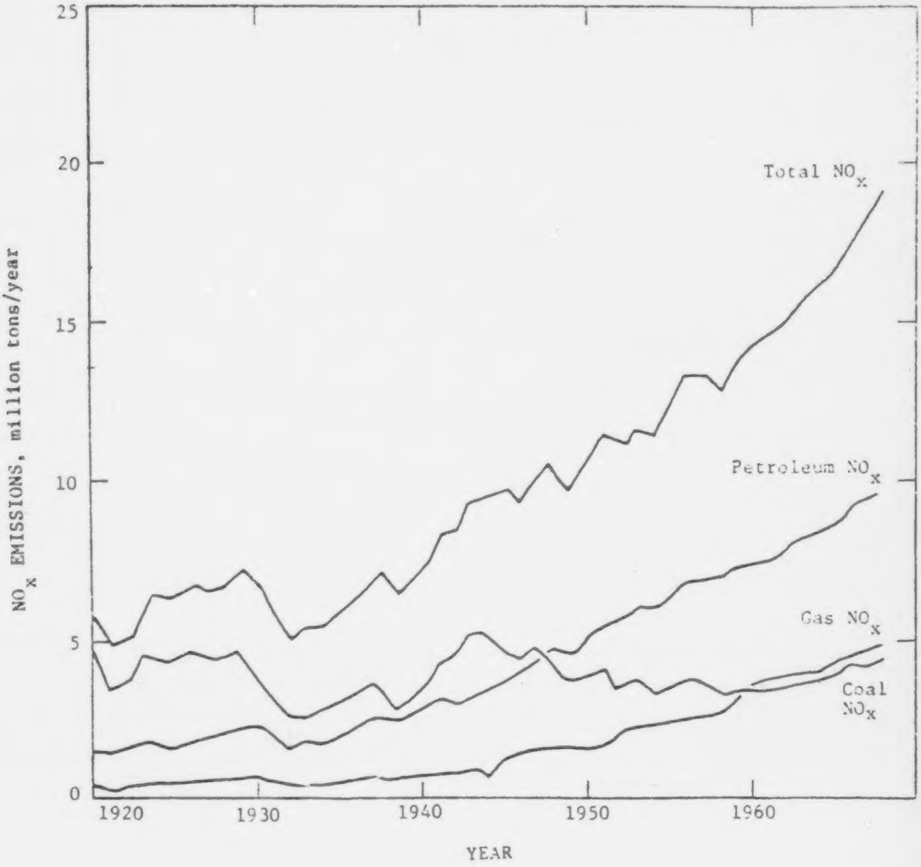


FIGURE 6. EMISSIONS OF NITROGEN OXIDES FROM FOSSIL FUEL COMBUSTION, MILLIONS OF TONS PER YEAR (LAND, 1976)

ACID PRECIPITATION
REVIEW OF THE ISSUE

February 1981

N.Y. POWER POOL

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GLOSSARY

1. **Anion** - Negatively charged ion.
2. **Cation** - Positively charged ion.
3. **Deposition** - The depositing of substances on the earth. Deposition can be by two mechanisms: Dry or Wet. **Dry Deposition** is the transfer of airborne pollutants to the surface of the earth directly via sedimentation and impaction. **Wet Deposition** is the transfer of pollutants indirectly as a solution which is formed during condensation of atmospheric water vapor prior to or during rain storms.
4. **Hydrometeors** - A product (such as fog, rain or hail) formed by the condensation of atmospheric water vapor.
5. **Ion** - An atom or group of atoms that carries either a negative or positive electric charge as a result of gaining or losing one or more electrons. For example, the Hydrogen ion (H_{+}) has one electron less than the hydrogen atom.
6. **Ion Exchange** - A reversible interchange of one kind of ion present on an insoluble solid with another of like charge present in a solution surrounding the solid (softening of water).
7. **Isopleths** - A line on a map connecting points that have the same pH units.
8. **Long Range Transport** - The movement of a pollutant by winds to locations many hundreds of kilometers away.
9. **pH** - A value used to express the degree to which a liquid is acidified. A logarithm function where 7 is the neutral value and less than 7 is called acid. A decrease by 1 pH unit means an increase of acidity by a factor of 10. A liquid having a pH 6 will, therefore, be 10 times as acid as one with pH 7.
10. **Primary Pollutants** - Pollutants such as sulfur dioxide, nitrogen oxides, carbon monoxide, particulates, hydrocarbons that are emitted directly from a source.
11. **Receptor** - The point at which a pollutant impacts the earth.
12. **Scavenging** - A process that removes materials from the atmosphere.
13. **Sources** - The point of origin of a pollutant.

    Man-made Sources - Emission from man-made process such as combustion of fuels, automobiles, factories and airplanes.

    Natural Sources - Emissions occur from nature, such as swamps, lightning, forest fires, volcanoes.
14. **Source-Receptor Relationship** - The impact of emissions from one specific source at one specific point.
15. **Spatial Distribution** - The distribution of pollutants relating to space.

ABSTRACT

The purpose of this paper is to review acid precipitation. This review indicates that considerable uncertainty exists on all aspects of the issue, from defining the actual problem through defining the relative source contributions. Although lake acidification is commonly attributed to increased acidity in precipitation, there may be numerous other causes. Methods used to define trends are shown to be in possible error, and uncertainties associated with incorporation mechanisms, and transport and transformation processes demonstrate that the relative source contributions cannot be defined. Consequently, implementation of control strategies would be premature and not cost-effective.

I. INTRODUCTION

The acid rain phenomenon, which has attracted increasing attention in the media, is a major issue facing electric utilities. Congress and the Administration have become focal points of public pressure and are seeking a quick solution to the problem, likewise EPA is considering further reductions in the allowed amounts of pollutant emissions. The dilemma for the electric utilities, however, will be to meet strict pollution control requirements while providing for the electric energy needs of the nation at reasonable cost. Simultaneously, electric utility industry must meet the challenges of investigating the causes and effects of acid rain in order to ensure that any new control measures are prudent and based upon scientific fact.

Until a few years ago, health effects and vegetation damage by primary pollutants (those emitted directly by the source) were the main reasons for implementing stringent air pollution controls. Recently, however, attention is being directed toward the secondary pollutants: sulfates and nitrates (primary pollutants transformed by atmospheric processes) and to their impacts on visibility, precipitation acidification, and materials damage. However, relatively little is known about the effects of secondary pollutants in comparison to what is known about primary pollutants.

Secondary pollutants will be cited as justification for more stringent controls on existing primary pollutants in the upcoming revision to the ambient air quality regulations. New regulations based on inadequate scientific investigations of the effects of secondary pollutants could, therefore, result in emission limits that are unjustified, and cause unwarranted expenditures of this nation's limited financial resources without commensurate improvements of the environment.

Strategies to abate what is generally termed the "acid precipitation problem" cannot effectively be developed until the following are adequately evaluated: the cause of the problem, the effects of the problem; the atmospheric and chemical processes involved from the time of emission from a source (such as a power plant, an automobile, or a swamp) to deposition at a receptor (such as grass, soil, or a lake) the relative contributions from various sources; and the cost/benefit relationships necessary to correct the problem.

Evaluation of secondary pollutants and their impacts is more complex than the evaluation for primary pollutants. Long-range transport, numerous and competing chemical conversion mechanisms, prediction of longer lasting and more subtle effects, and a need for more detailed background and/or historical information combine to make the evaluation for secondary pollutants more difficult.

The impacts of primary pollutants are easier to analyze than those for secondary pollutants since the source to receptor relationships for primary pollutants and the relative contributions from various sources are more easily defined. Distances and time scales are shorter and the importance of cost/benefit analyses are primarily related to the protection of human health.

Consequently, ambient air quality standards for primary pollutants are established to protect human health and welfare while limits for secondary pollutants would have to be based on somewhat nebulous impacts.

Issues related to acid precipitation and essential research needs are outlined in this paper. First, the problem will be defined and then various causes of acid precipitation will be identified. Next the source-receptor relationships will be evaluated. Finally, the issue of acid precipitation will be summarized, and suggestions will be made for improving the state of knowledge on the causes and mitigation of the impact of acid precipitation.

II. DEFINING THE PROBLEM

The chemistry of precipitation was initially analyzed for nutritional properties. Nitrogen and chlorine compounds were first studied in the early 1800's, and sulfur compounds in the early 1900's. Acidity of precipitation did not become a concern until the 1950's, when the Scandinavian countries began monitoring the pH of rain. Increased acidification of lakes and the decline of fish populations, first reported in the 1920's, were generally attributed to the purported increase in precipitation acidity, even though no direct evidence was available, it was convenient to attribute the increased acidity to the increase in man-made emissions that occurred during the same time period.

Research and speculation was initiated in the United States, when it was observed that the precipitation in the northeastern United States was also quite acidic. Since acid precipitation is purported to cause acidification of lakes and subsequent detrimental effects, it has been assumed that, through similar but not well-defined mechanisms, it can also cause other effects, such as reduction in soil fertility, forest growth, and crop productivity. In reality, these latter effects have been assumed, not observed.

Speculation and conjecture have created a need for identifying the causes of increased acidity in lakes and the best mitigating measures. Without such information regulatory decisions, which may adversely impact the electric utility industry, would be made without the benefit of scientific investigation. Attributing increased lake acidification to the purported increase in precipitation acidity because both are supposed to have occurred over the same time period appears to be too simplistic. As stated in the next section, a variety of potential causes for increased lake acidity need to be investigated.

III. CAUSES OF THE PROBLEM

While it has been popular to attribute the problem of lake acidification to the purported increase in precipitation acidity, increasing evidence indicates that a simple cause and effect relationship cannot be assumed. A number of other natural and man-made activities and processes could contribute to, or be a major cause of, lake acidification. Some of the activities that may contribute to the acidification of lakes in Scandinavia and the northeastern United States include changes in land use, dry deposition of atmospheric pollution, and natural lake acidification processes. Therefore, all probable causes must be investigated and the relative contribution of each cause must be determined.

Changes in land use policies can have a dramatic effect on the acidity of lakes and rivers. Rosenqvist(2) and

Seip and Toilan(3) recently debated a number of alternative causes for the acidification of rivers and lakes in Sweden. Rosenqvist contends that the decline of Norway's salmon industry and the acidification of its lakes can be explained by "ion-exchange processes in the catchment area and only to a minor degree to the H^+ content of the precipitation."(3) The ion-exchange processes referred to have come about because changes in agriculture, cattle farming, and forestry have affected the composition of the organic humus layer. A decrease in cattle farming and a change from semi-nomadic to restricted-range cattle farming has allowed much of the pasture land to revert to forest and heathland, thus increasing the amount of raw humus on the soils. Rosenqvist contends that the input of acidity from this mechanism is much greater than from precipitation.

Seip and Tolland(3) conclude that while Rosenqvist's reasoning may be applicable in some areas, it cannot be supported in many others. They support the hypothesis that the acidity in precipitation is the cause of increased acidity in lakes based on statistical evidence that correlates factors such as: well-documented acidification of precipitation in recent decades; coincidence of acid lakes and rivers, where the acidity has no previous sources in the drainage basins; coincidence of areas with both high deposits of acid precipitation and geological conditions that do not favor neutralization of acid; and biological indications of acidification.

While the effects of acid precipitation have been widely discussed, practically no consideration has been given to the effects of dry deposition which also contributes to removing substances from the atmosphere. In the eastern United States, it rains about one-third of the days or parts of days annually. Therefore, it is important to determine the relative contribution of the two major deposition processes to the effects attributed to atmospheric deposition in general, since it has been estimated(4) that the eastern United States receives about equal amounts of a given constituent from dry and wet deposition. Determining the relative contribution of the deposition processes will facilitate identifying cost-effective control strategies.

The National Atmospheric Deposition Program (NADP), which is funded by the U.S. Department of Agriculture and, in part, by Empire State Electric Energy Research Corp. (ESEERCO), has undertaken a national program to determine the relative contributions of the deposition process. Because dry deposition is a much more important issue than wet deposition in a large part of the western United States, the NADP included it and its effects in their program, which includes bi-monthly dry deposition sampling.

Numerous natural processes are also suspected to cause increased acidity in lakes. These processes have to be identified and their time scales must be determined. This information is needed to determine a natural background or baseline condition against which to evaluate the impacts from man-made causes.

Further study of changes in land use, dry deposition, and natural lake acidification are required to determine whether and to what extent they contribute to lake acidification. Without this approach, available research and pollution control funds could be spent in an ineffective manner.

IV. PRECIPITATION ACIDITY — THE COMMONLY ATTRIBUTED CAUSE OF LAKE ACIDIFICATION

A. Historical Data

It is the opinion of some researchers that both the trend of acidity in precipitation and the land area affected have been increasing for the past 25 years. They attribute this increase in acidity to the concurrent increase in the use of tall stacks at power plants and other industrial sources, and that the acidity in precipitation was increasing in magnitude in the northeast and spreading westerly and southerly. Most of the claims for increasing acidity of precipitation are based on maps (see Figures 1 and 2), published by Cogbill and Likens(5) (1974), and by Likens(6) (1976). Employing chemical data previously published, predictions of the pH values for the northeastern United States were made by Cogbill and Likens(5) for the time periods 1955-56 and 1965-66. These maps purport to show an increase in acidity of rain and in the area being affected by such rain for three time periods (1955-56, 1965-66 and 1972-73).

While these opinions seem to have received widespread acceptance, a careful analysis of the research shows many problems exist with the quality and quantity of the data then used to define trends. In other instances, the problem does not lie in the data themselves but in how they were used by Cogbill and Likens to estimate the pH of the precipitation and to define trends. Cogbill and Likens assumed that if all of the major constituents were measured, the hydrogen ion concentration (pH) could be calculated based on balancing the constituents with hydrogen ions. This assumption is only true within the accuracy of the chemical analysis.

Additional uncertainties with the Cogbill and Likens analysis that make their conclusions highly questionable include:

(1) Comparisons from one time period to the next were made with data from non-identical sites.

(2) Comparisons were made between data collected over different time periods.

(3) There was a lack of and/or differences in sample preservation techniques among the data sets.

(4) The isopleths were drawn incorrectly in a number of cases and were generally not valid because of the paucity of data points especially towards the south and west.

(5) An analysis of the data for only those locations that appeared to remain fixed in each of the study years show that some sites have an increasing acidity trend and others a decreasing trend.

(6) The observed year-to-year variability in annual average precipitation acidity data (see Figure 3) is so large that comparing one year periods which are ten years apart without any intervening data can cause an error in determining the actual trend.

An examination of Cogbill and Likens, and Likens 1955-56 and 1972-73 maps, shows that only two stations are common to the two maps and at those stations there is no common trend. At the station in Maine, the pH decreased and at the station in New York, the pH increased. A comparison of the 1955-56 and 1965-66 pH COMPARISONS FOR 1955-56 AND 1965-66

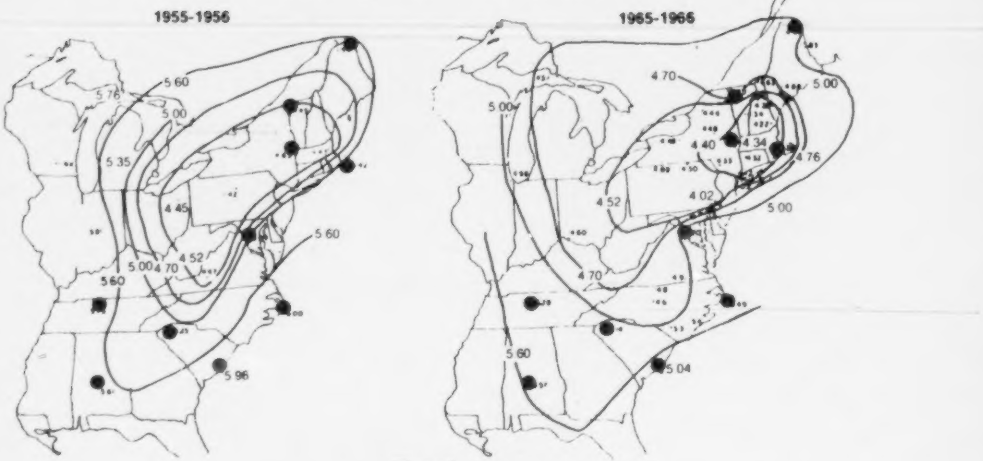

1955-1956
5.76
5.60
5.00
5.35
4.45
4.52
5.00
4.70
5.60
5.60
5.96
1965-1966
4.70
5.00
5.00
4.40
4.34
4.76
4.52
4.02
5.00
4.70
5.60
5.04

Figure 1

pH COMPARISONS FOR 1955-56 AND 1972-73

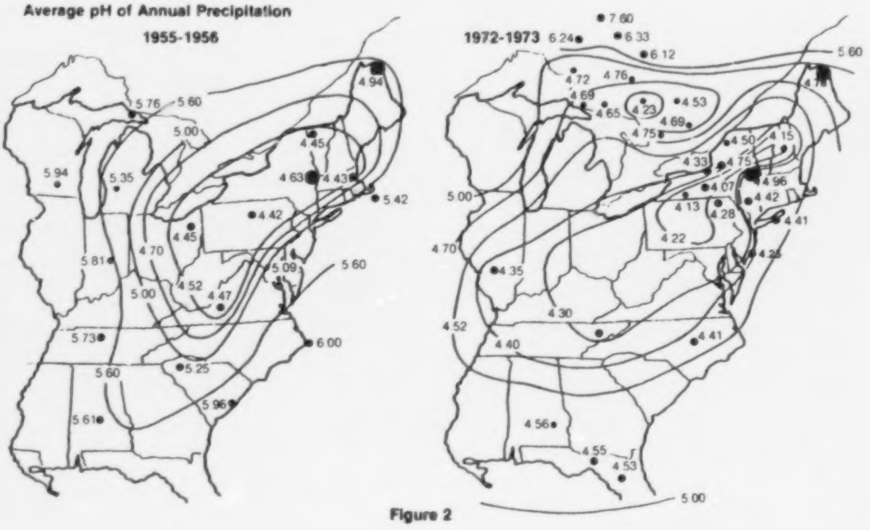

Average pH of Annual Precipitation
1955-1956
5.76
5.60
5.00
5.94
5.35
4.94
4.45
4.63
4.43
5.42
4.42
4.45
4.70
5.81
5.09
5.60
4.52
4.47
5.00
5.73
6.00
5.60
5.25
5.96
5.61
1972-1973
7.60
6.24
6.33
6.12
5.60
4.72
4.76
4.78
4.69
4.65
4.23
4.53
4.75
4.69
4.50
4.15
4.33
4.75
4.96
4.07
4.42
5.00
4.13
4.28
4.41
4.22
4.70
4.35
4.25
4.30
4.52
4.40
4.41
4.56
4.55
4.53
5.00

Figure 2

pH (EVENT BASIS) VS. TIME
SCRANTON, PENNSYLVANIA

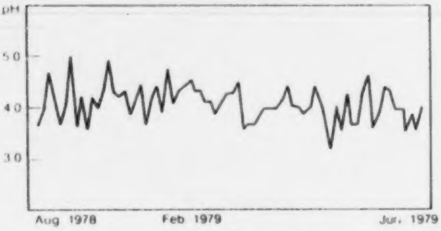


Figure 3

maps shows that only ten stations are common, although the maps report data from a large number of sites. A comparison of the data from the ten common stations shows that the acidity increased at four, decreased at two and remained unchanged at four. A similar comparison between 1965-66 and 1972-73 maps shows that only eight stations are common, although these maps also report data from a large number of sites. Of the eight common sites, the acidity increased at three, decreased at two, and remained the same at three. The reported trends fail to materialize, if only data from common stations are compared.

Data should be collected continuously at one or more sites over a number of years to accurately establish a trend. Perhaps the site that best meets that requirement is at Hubbard Brook Experimental Forest in New Hampshire (Figure 4), where continuous measurements were taken over a 10-year period. According to Likens et al. (1977, p. 36), "There has been a slight upward trend in concentration of hydrogen ion between 1964-65 and 1970-71, followed by a downward trend until 1973-74; overall (1964-1974), however, no trend in concentration is statistically significant." Another survey of nine sites

pH OF PRECIPITATION AT
HUBBARD BROOK, NEW HAMPSHIRE

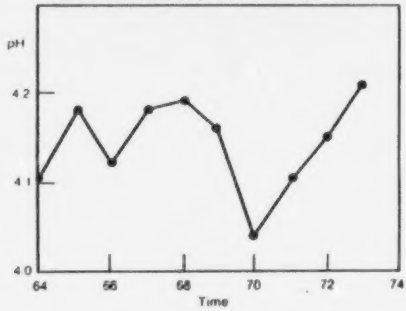


Figure 4

pH OF ATMOSPHERIC DEPOSITION AT FIVE SITES
IN NEW YORK STATE
(from U.S. Geological Survey)

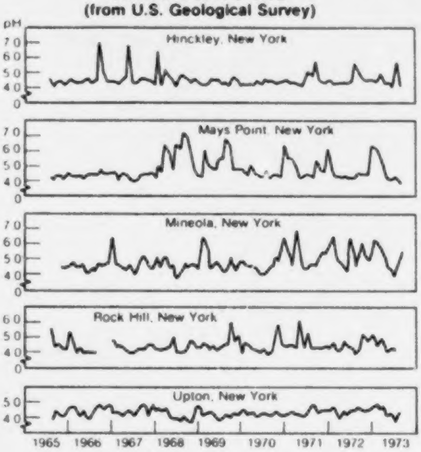


Figure 5

pH OF ATMOSPHERIC DEPOSITION AT FOUR SITES
IN NEW YORK AND PENNSYLVANIA
(from U.S. Geological Survey)

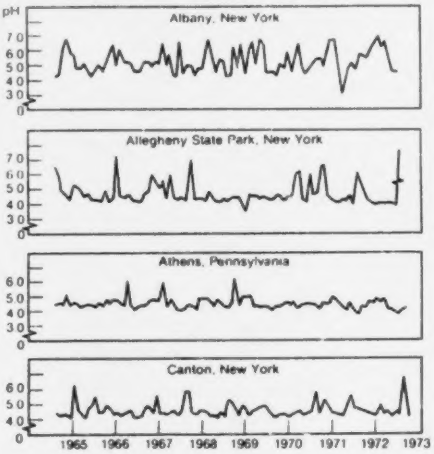
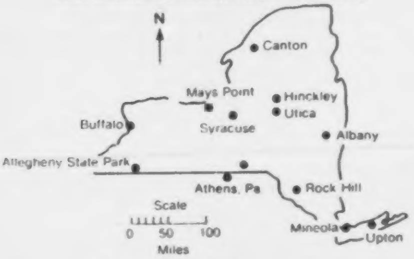


Figure 6



LOCATIONS OF
U.S. GEOLOGICAL SURVEY STATIONS

Figure 7

maintained by the U.S. Geological Survey in New York State (Figures 5, 6 and 7) showed no apparent trend in acidification over the 8-year period from 1964 to 1973.

The trend toward an increase in precipitation acidity has generally been attributed to the increased man-made emissions of sulfur and nitrogen oxides; however, there may be other causes for this trend. Stensland(8) has recently shown that the observed increase in precipitation acidity in Illinois can be explained by the decrease in neutralizing constituents (e.g., Ca, Mg, K), which are primarily derived from windblown soil even though the amounts of acidifying constituents (e.g., SO_x, NO_x) in the precipitation have remained about the same. One explanation for this decrease in precipitation acidity is that the base year, 1955-56, was abnormally dry in the midwest, which could have increased levels of windblown dust in the atmosphere. While this result is not necessarily transferable to other regions, it implies that such things as droughts, changes in farm practices or activity, and increases in lake areas (i.e., in the Southeast) can have a dramatic effect on precipitation chemistry and hence, on its acidity.

It has also been suggested that the increase in the number and use of tall stacks at power plants and other industrial sources in the midwest has contributed to the trend toward increasing lake acidification in New York State. Environmental Research and Technology, Inc. (ERT) recently reported(9) that the aquatic environment of certain remote, soft water lakes in the northeast has been impacted, though "this conclusion itself is by no means accepted without controversy..." Additionally, this same study contends that the suggestion that SO_2 emissions from western states may contribute to northeast acid rain "is not and could not be the case ... The long-range transport of sulfates over distances greater than 1000 km is rare."

B. Constituents Affecting Precipitation Chemistry

It is necessary to identify all the constituents of precipitation that can contribute to the formation or reduction of acidity. It is generally assumed that the acidification of precipitation is caused principally by the presence in the atmosphere of sulfur dioxide (SO_2) and nitrogen oxides (NO_x), however, the following atmospheric constituents must also be examined:

1. Carbon dioxide and carbonic acid
2. Hydrochloric acid and chloride salts
3. Ammonia and ammonium salts
4. Organic acids
5. Major neutralizing metals and their associated compounds (e.g., Ca, Mg, K, Na)
6. Trace metals

Carbon dioxide in the atmosphere will, to a certain extent, dissolve in rainwater to form carbonic acid. The pH of a pure water droplet in equilibrium with the average carbon dioxide concentration of the atmosphere is 5.65, which is considered the neutral point of precipitation. Any precipitation with a higher pH value is alkaline and below is acidic. While this may be a theoretically acceptable pH value for rainwater, it should not be considered the background or natural acidity of precipitation. Even without man's influences, there are natural sources of sulfur oxides, nitrogen oxides, and other elements (e.g., forest fires, swamps, sea salts, volcanoes) that contribute to precipitation acidity. Therefore, an accurate determination of the natural or background condition is difficult. This is particularly true when attempting to characterize changes in natural emissions due to changes in land use.

A common analyses performed on precipitation chemistry data involves calculating the relative contribution of various constituents to the acidity. The problem with this calculation lies in the accounting for, and apportionment of, the neutralizing cations to their respective anions. The assumption that is implicit in this calculation is that the cations are associated with anions in proportion to the concentration of the anions, which may not be true. It is conceivable that a greater proportion may be aligned with a specific anion. If this were the case, it would change the relative contributions to the acidity. Knowing the important atmospheric constituents (e.g., SO_x, NO_x, or Cl) will be the only way of focusing attention on the proper chemical source to control, thereby facilitating the development of effective control strategies.

C. Atmospheric Constituent Incorporation Mechanisms

Various atmospheric constituents can become incorporated into hydrometeors by the following three basic mechanisms. The constituents can act as a condensation nuclei, be collected by impaction, or be collected by diffusion. Research is being conducted to assess the importance of each of these mechanisms. Until more quantitative results are obtained, it will be difficult to determine which mechanisms are important under a given set of conditions.

An example of the difficulties in determining which mechanism is most important, relates to the scavenging of sulfur dioxide gas by precipitation. Theoretically, the amount of dissolved SO_2 in precipitation should increase in the winter when temperatures and acidities are low. This theory is supported by some monitoring data, which shows that dissolved SO_2 concentrations are higher in winter than in summer. The results of studies done on winter storms in the Great Lakes region however, indicates that there was significant particulate SO_4 in the precipitation. Hence, SO_2 scavenging may not be the dominant mechanism. It is important to determine which mechanism is important, and when it is important, since a strategy designed to control SO_2 may be different from one designed to control SO_4.

The same difficulties can be associated with the incorporation of nitrogen oxides.

D. Transport and Transformation

Many different atmospheric constituents contribute to precipitation acidity, and the constituents can be incorporated into precipitation in many different forms. It is, therefore, important to know from where each constituent originates and how it was transported prior to becoming incorporated into the hydrometeors (transport and transformation processes).

Current research involves the development of transport models that attempt to combine atmospheric dispersion and atmospheric chemistry. Although the models are very sophisticated, they don't adequately account for dry deposition or other important factors such as the vertical structure of the atmosphere.

Many transformations can occur to atmospheric constituents between emission and incorporation. Although many of these mechanisms are known qualitatively, little is known quantitatively. Mechanism rates vary greatly with temperature, relative humidity, solar radiation, concentrations, and the availability of other essential constituents. Also, the competitive nature of many of the mechanisms makes it difficult to define their relative importance. Data on the relative importance of the mechanisms is needed to determine where to focus pollution control efforts to judiciously deploy mitigating measures. This same reasoning also applies to other potential regulatory areas such as sulfates, nitrates, and fine particulates.

E. Relative Source Contributions

The relative importance of natural and man-made sources depends on the geographic area being considered (e.g., global, regional or local) and specific pollutants. On a regional and/or local basis, one pollutant can easily dominate, since the different pollutants have different spatial distributions. On a global basis for example, sulfur oxide emissions from man-made sources are about equal to those from natural sources, and natural emissions of nitrogen oxides far exceed man-made emissions.(10) Lightning is a source of gaseous NO_x and may very well be the largest source. On a regional scale, the relative importance of each source is questionable at this time. Uncertainty lies in all of these estimates because of the lack of data on natural emissions and most estimates are derived from the balancing of budgets. The need for more research to measure natural sources and the relative importance of natural versus man-made is evident.

The relative importance of each pollutant must be considered along with the other factors such as source emissions, transport mechanisms, transformation processes, and incorporation mechanisms.

F. Potential Control Strategies

Development of mitigation strategies should not be implemented until a reasonable amount of confidence is obtained on which pollutant and sources to control. It is reasonable to expect, however, that strategies designed to control acid precipitation may be proposed before a reasonable amount of scientific data is obtained. Acid precipitation is being considered in the new criteria documents that will be used by EPA as justification for controlling emissions of nitrogen oxides, sulfur oxides, and particulate matter. Mitigating acid precipitation has been indirectly used as a justification for limiting stack heights and/or stack height credits and has also been a major topic at a recent meeting between United States and Canada environmental agencies.

Numerous methods could be implemented, if it is determined that man-made sources of sulfur oxides and nitrogen oxides are the major contributors to acid precipitation. New Source Performance Standards could be tightened further; however, this action would most likely serve only to slow the rate of increase in total emissions and protect local areas from any effects attributable directly to the new source. Another method would be to reduce the present level of total emissions on existing sources. This approach would provide a high degree of uncertainty because the high cost of reducing emissions to some arbitrary level could result in large financial expenditures or possible job losses should plants have to close, while achieving only a minimal, if any, reduction in precipitation acidity.

One control strategy which has been suggested by environmental groups is to impose a national or regional emissions cap which would limit total emissions while allowing some latitude for emissions reduction strategies. It is hoped that this approach would stabilize precipitation acidity at an acceptable level. Further reduction in the emissions ceiling would be required if precipitation acidity were not acceptable. The most significant problem with this strategy is that it does not address the source-to-receptor or cost-effectiveness issues. Also, the program administration may become arbitrary. Sources that do not contribute to the problem may be controlled, resulting in the unnecessary fiscal expenditures while others are left unabated only to exacerbate the problem.

In New York State, it has been assumed that the possible conversion of a number of oil-fired generating stations to coal will result in a dramatic increase in sulfur emissions. Using the assumption that all reasonable coal conversions will take place, the New York Power Pool has conducted a recent study that indicates that the net statewide emissions of SO_2 will increase only a few percent through 1990. Also, New York has for the present, precluded nuclear power. Certainly one viable alternate method of limiting these SO_2 emissions would be to reduce our dependence on fossil fuels by increasing reliance on nuclear power. This option, however, is not presently available in New York State, where the development of nuclear powered generating stations has been restricted by regulatory agencies.

V. SUMMARY

We have attempted to demonstrate the complexities and uncertainties associated with acid precipitation. It has been shown that even defining the potential causes and the impacts of acid precipitation is complex. While it is assumed that acid precipitation causes various impacts, it is unclear what actually causes lakes' acidity. Most of the current theories are based on possibly coincidental correlations and very little effort has been expended to investigate other possible causes. Sources other than man-made emissions must be investigated and the relative contributions of the different sources must be determined.

We must accurately determine the level of emissions that would effectively mitigate the precipitation acidity problem. This is not possible without first acquiring a thorough knowledge of the source-receptor relationships discussed in this paper. Until these questions of the source-receptor relationships are answered, or at least partially resolved, any conceived control strategy runs the risk of being ineffective, resulting in unnecessary expenditures of our limited financial and energy resources. In other words, one must determine what pollutants to reduce, by how much and under what conditions, to result in a reduction of precipitation acidity. The cost of this reduction and the value of its benefit must be assessed, and then determined if the benefit to be achieved is worth the cost of control.

New control strategies may be hastily implemented by Congress, the Administration, and the EPA in spite of the uncertainties and pleas for more time to investigate the issue thoroughly. Ill-conceived control strategies will severely impact electric utilities and affect their current and future plans for expansion to meet the increasing demand for electric power while being extremely costly and have questionable benefits for the environment.

Significant resources are being devoted to research all phases of acid precipitation. The scientific information needed to develop appropriate mitigation strategies will be available in an acceptable time frame, if the level of research now being conducted can be maintained, and if deficient areas of knowledge can be strengthened. To decide on a specific control strategy at this time without the necessary research would be a mistake. The New York State electric utilities either individually or collectively through ESEERCO are supporting this research.

Without a commitment by this country to a long-term monitoring program consisting of proper sampling methodology, frequency, density and quality control, and directed toward well-defined objectives, it will be impossible to unravel the uncertainties that now exist. Clearly, a reasonable approach would be to evaluate trends based upon a large data base collected over a period of time.

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TO: Senator Daniel P. Moynihan
U. S. Senate Environment & Public Works
U. S. Senate
Washington, D.C.

FROM: Anne LaBastille, Ph.D.
Commissioner
c/o Adirondack Park Agency
Box 704
Lake George, NY 12845

HEARING ON ACID RAIN AND THE CLEAN AIR ACT

Testimony by Dr. Anne LaBastille on July 1, 1981

HEARING ON ACID RAIN AND THE CLEAN AIR ACT

I would like to address the impacts of atmospheric pollution, both the ambient forms and wet deposition, on the Adirondack Park, a downwind receptor to pollution sources in the Midwest. I shall qualify my remarks by noting that these impacts are the cumulative effect on ecosystems of several years of atmospheric pollution which has been largely invisible, gradual and insidious. Also, that it is impossible to draw a line between SO_2, SO_X, NO_X, total suspended particles (TSP), traces of heavy metals, ~~and~~ dry deposition, and wet precipitation because the process from emissions to fallout is a continuous one of transformation and transportation, and all these forms of atmospheric pollution are present in the Adirondacks.

My background and reasons for coming today are the following: I am a concerned citizen and scientist (ecologist) who has lived in the Adirondacks for almost 25 years and seen my lake go from a prime trout fishing spot to one devoid of fish. I'm also a Commissioner for the Adirondack Park Agency, a state land use planning agency responsible for the 6-million-acre Adirondack Park. This area is the largest State park in the USA, and one in which we could fit five National Parks: say Yellowstone, Grand Tetons, Olympic, Smokey Mountains, and Everglades within the Blue Line which defines it. In addition, I've been fortunate to be the writer of an acid rain article for National Geographic this past year. Thanks to their generosity, I have traveled widely through the United States, Scandinavia, Switzerland and Hawaii meeting scientists and attending conferences dealing with acid deposition. This has given me a broader view of the phenomena, taking it from a regional perspective to a global exposure.

Just a word about the Adirondacks themselves. It is the first high land mass after the midwestern plains, with elevations to 5,000 feet. They hold roughly 3,000 lakes, 30,000 miles of rivers and streams, and sensitive soils which are naturally thin and acidic. There is very little buffering capacity in either soils or waters; no industry, virtually no agriculture. The mountains are a prime tourist area, and approximately nine million visitors come each year. It is interesting to note that the Adirondack Park was formed by a New York State Constitutional law in 1892, and in 1894 the 14th Amendment gave lasting protection to the state lands within this Park with its "forever wild" provision.

There are four major areas of impact of atmospheric deposition, all of which are linked ecologically together. They are: aquatic ecosystems, air quality, forests and soils, and ground/surface waters.

Aquatic ecosystems show the greatest impacts in that almost 300 lakes and ponds in the Adirondacks are now fishless, and an equal amount threatened. Investigations have been carried out by New York State's Department of Environmental Conservation. In addition to fish, other aquatic life show changes due to acidic deposition. Aquatic insects either die off, or thrive when relieved of fish predation pressures, depending on their sensitivity to acidity. All plankton is affected and decreases to the point where a lake becomes very clear and often bluish in color. Wildlife diminishes as fish-eating species such as mink, otter, herons, and certain ducks are forced to move to new habitats or starve. In general, Adirondack~~s~~ lakes affected by atmospheric pollution and deposition are less productive, useful, and fun to humans, Real estate values, tourism, and outdoor recreation suffer. The Adirondack Park Agency estimated in 1975 that there is a $1.5 million loss per year due to sport fish decreases.

Air quality and clarity in the mountains has diminished. Early reports by surveyors such as Verplanck Colvin, and explorers in the mid- to late-1800's tell of sparkling bright days with magnificent vistas and scenes. However, the last two to three decades have brought a decrease in clarity and episodes of dry, hazy weather with visibility much curtailed. The various measurements made by atmospheric research scientists indicate that atmospheric pollution in this area, a downwind receptor to the midwest, is responsible, including SO_2, SO_X, TSP, etc. Two atmospheric scientists, Ray Falconer and Vincent Schaeffer, have noted from personal observations that in the past 15 years summertime visibility has worsened and is interfering with the magnificent views.

In the Adirondacks, we have little cultural heritage in the form of famous old churches, monuments, or stone buildings which can be corroded by acid rain. However, our heritage is our natural beauty. This is partly what brings those nine million tourists a year. If we were a National Park, our air quality would be classified as Class I; and indeed, our 1.1 million acres of wilderness is equivalent to this rating. The present pollution of our visibility is harming our heritage, spoiling tourism, and surely lowering the amount of photography done.

Forest ecosystems, and their supporting soils (substrate), are another arena feeling the impacts of atmospheric pollution and deposition. As yet, there is no conclusive proof in nature that injury occurs; however, in growth chambers, field plots and lab tests with simulated air pollution (SO_2, etc.) and precipitation (acid rain), definite damage has been shown. Some effects are: injury to leaves and fine root hairs, lowering of disease and insect resistance, decrease in soil organisms responsible for organic breakdown and decay, and a slowdown in nutrient cycling of the ecosystem. We are suspicious that these same effects are taking place in Adirondack forests and soils, but it will take more study and proof. Trees take time to show stress and damage due to pollution in nature.

The acidification of ground and surface water in the western Adirondacks is a growing problem, much the same as in western Sweden. Two years ago, I guided Dr. Wolfgang Fuhs, an environmental scientist from the New York State Department of Health, to a number of small municipal reservoirs, wells, and natural springs. He sampled domestic water and found most homes with elevated levels of copper, lead, and aluminum. Residents of certain hamlets in the western Adirondacks are complaining that their plumbing corrodes rapidly as acidified water leaches copper from the lines and lead from the solder. In addition, these natural springs sampled showed high levels of copper and aluminum. Since these springs are back in the woods untouched by human hands, these heavy metals are being mobilized and transported from surrounding soils by acidic precipitation. Acidified drinking water can be a potential health problem over long periods. As it is now, the Adirondack Park Agency recommends to residents of these areas to allow their faucets to run for a few minutes each morning (or after any period of non-use) in order to flush heavy metals out of the lines.

These four areas of impact mentioned above have been occurring within the last three decades. Before that, and back to the Ice Age some ten to twelve thousand years ago, no such phenomenon took place. Nature apparently had her own system of checks and balances which neutralized natural atmospheric pollution and acidic deposition. But now the environment is unbalanced. All the correlative evidence points to the cumulative effects of atmospheric pollution and deposition as producing serious ecological problems.

Thank you.

* * *

STATEMENT OF THE ADIRONDACK PARK AGENCY
WITH REFERENCE TO ACID PRECIPITATION,
JULY 1, 1981

The Adirondack Park Agency is an independent part of the Executive Department of the State of New York. It is responsible for regional land use planning and development regulation of the private and public lands of the Adirondack Park. We are charged by our statute with "responsibility for developing long-range park policy in a forum reflecting statewide concern." The Agency is a member of the NYS Interagency Task Force on Acid Precipitation chaired by the NYS Department of Environmental Conservation.

The Adirondack Park is an area of about 6 million acres, or about the size of the State of Vermont. There are 3.7 million acres (about 60%) of private land in the Park and 2.3 million acres (about 40%) of state-owned "forever wild" lands protected by the NYS Constitution as the NYS Adirondack Forest Preserve.

The Adirondack Park is the permanent residence of approximately 125,000 individuals. Some nine million tourists visit the region annually. Employment is heavily dependent on tourism, the forest products industry, mining and other service industries.

The Agency would like to make four points regarding the subject of Acid Precipitation in the Adirondacks:

First, the Adirondack Park Agency was the first agency of the State of New York to draw attention to the policy implications of acid precipitation in a position paper released in 1975 (copy attached). While we are not responsible for primary research into the effects of acid precipitation, we have followed the research of others with obvious interest and concern. We vigorously supported federal legislation, passed as the Acid Precipitation Act of 1980 (Title 7 of Energy Security Act of 1980, P.L. 96-294), and have consistently called for protection of the fragile ecology and economy of the Adirondack Park from the long-term degradation acid precipitation brings. I reaffirm that position today.

Second, the Adirondack Park is an area of vast resources, and relatively few people. The fact that our resources are under-represented in Washington should not be taken as an invitation to use the Adirondack Park as a dump for the nation's long-range atmospheric pollution. This is a problem for federal action. The Adirondacks are the archetype of a region of abundant natural wealth with a small political voice. We need a strong, consistent federal policy. We do not need the State of New York pitted against the State of Ohio in protracted and costly litigation.

Third, this is a problem that demands action now. Turning acid precipitation into a political football could do as much indirect economic damage, at least in the short run, as the rainfall itself. Misstatements in the popular press portraying the Adirondacks as "dead" or as remote and wild without people, industry, or culture, do a disservice to the people of this region who are deeply committed to maintaining the Park's environmental quality.

The Adirondacks are not dead. That there are some dead lakes is a symptom of a disease that is progressing and that must be treated and arrested. The natural resources that as yet are relatively unaffected should be our greatest concern, since they continue to draw the millions of visitors to the region each year.

Fourth, the Clean Air Act must address this issue. If under the Clean Air Act as presently implemented, the acid precipitation problems continues, then the Clean Air Act must be reviewed and materially strengthened.

The National Commission on Air Quality stated in its final report "that the pollution control costs incurred to comply with current air pollution control regulations should not inhibit long-term nationwide development of any domestic energy source, particularly coal."

The economic implications of acid precipitation effects are only beginning to be explored. There is urgent need for more attention to this side of the problem as specific Clean Air Act provisions are addressed.

Clean air cannot be treated solely as a local problem or resource. Interstate and international effects should be an essential consideration toward strengthening the Clean Air Act. Congress should specifically address long-range transport and acid precipitation in this respect.

The Adirondack Park Agency -- on behalf of both the citizens and the natural resources of this region -- urges federal action now to protect its citizens from the economic consequences of acid precipitation and to extend the protection the State has afforded its abundant water resources for nearly a century to this new threat.

# # #

May 23, 1975

STATEMENT OF THE ADIRONDACK PARK AGENCY
ON
ACID PRECIPITATION AND ITS EFFECT ON THE ADIRONDACK PARK

THE ADIRONDACK PARK

New York State's Adirondack Park constitutes one of the last large wilderness and semi-wilderness areas east of the Mississippi. Its rugged mountains, clear lakes, tumbling streams, winding rivers and great forests cover approximately 9,000 square miles of northern New York. A major source of water for five important water systems (Black River Basin, Lake George-Lake Champlain Basin, Mohawk River Basin, St. Lawrence River Basin and Hudson River Basin) that draw from its thousands of lakes and streams, a home for an abundance and variety of plants and animals, and a land of clean air, cool summers, harsh winters, and rugged beauty, the Adirondack Park constitutes a unique natural area that also serves man's needs for natural resources, a place to live, recreation, aesthetic enjoyment and peaceful solitude. Created as a State park in 1892, the Park's lands are subject to stringent and far-reaching land use controls. The forty percent of the Park owned by the State of New York (approximately 2,300,000 acres) is protected by the "forever wild" clause of New York's Constitution. The remainder of the Park's 6,000,000 acres, owned by private citizens, corporations, municipalities, and other entities, has been governed since 1973 by the Adirondack Park Land Use and Development Plan, a regional land use plan that mandates the protection and wise use of the Park's resources and that is administered by the Adirondack Park Agency.

THE PROBLEM

Despite the protections afforded the lands and resources of the Adirondack Park by generations of New Yorkers, the Park's unique and irreplaceable resources may be seriously threatened by airborne gases (mainly sulfur and nitrogen oxides) that are discharged into the atmosphere as a result of fossil fuel combustion far from the Adirondacks. These gases are converted in the atmosphere to strong acids that eventually fall to the ground as acid precipitation ("acid rain"). Acid precipitation is making many Adirondack lakes unsuitable for the survival and propagation of fish and other aquatic organisms and may be a threat to vegetation and soil resources in the Adirondacks.

The acid precipitation phenomenon is exceedingly complex. It is difficult to determine the exact geographical location of sulfur and nitrogen oxide emission sources that cause problems in the Adirondacks, the manner in which these pollutants are mixed with and transported by the atmosphere, and the actual mechanisms by which these oxides are converted in the atmosphere into sulfuric and nitric acids. There are substantial questions regarding the feasibility of using existing technology and other power sources to control these emissions. Impacts of acid precipitation on water quality and fish populations have been studied in several locations, including the Adirondacks. Specific impacts on soils and vegetation have been defined to only a limited extent. The nature of the impacts caused by acid precipitation on economic and social values are at the present largely unknown.

Based on the information now available, it is clear that acid precipitation has already severely damaged a portion of the Adirondacks' resources. Due to the low acid neutralizing (buffering) capacity of many bodies of water in the Park, fish populations have declined, disappeared or become endangered in 11,546 acres of Adirondack lakes and ponds at elevations of 2,000 feet and greater primarily because of acid precipitation. Two-thirds of the lakes in five State Wilderness areas in Herkimer County (Five Ponds, Pigeon Lake, Pepperbox, West Canada Lakes, and Ha-De-Ron-Dah) are chemically unsuitable for the survival of fish. Adverse effects on other aquatic organisms and ecosystems are also occurring. Although Adirondack plants and soils presently appear capable of neutralizing acids introduced by precipitation, their capacity to continue doing so is unknown. While no decreases in forest production in the Adirondacks have been documented, undesirable reductions in plant growth may eventually occur in the Adirondack Park unless the acid precipitation problem is solved.

The physical and biological impacts of acid precipitation on Adirondack resources may cause substantial negative economic and social losses in the Adirondacks. Recreational losses due to the decline and disappearance of fish populations is already occurring. Declines in the growth of commercial forest timber, reductions in maple syrup production and losses of agricultural crops, if they occur, may seriously aggravate the economy of an already economically depressed area.

The degradation and loss of the quality of Adirondack resources constitutes a social cost that cannot be measured. The bountiful resources of the Adirdondacks contribute in large measure to the physical and emotional well-being of countless persons throughout New York State and the eastern parts of the United States and Canada. The destruction or serious degradation of these resources would remove a vital link from the environmental fabric that is essential to the preservation of man's well-being.

There is substantial evidence that the major sources of the pollutants causing the acid precipitation problem in the Adirondacks are motor vehicles, and industries and electric power plants (especially coal-fired plants) located in the midwest and northeastern United States and southeastern Canada. Power plants discharge quantities of sulfur oxides and motor vehicles discharge quantities of nitrogen oxides into the atmosphere. Sulfur oxides, retained in the atmosphere for an average of two to four days, and nitrogen oxides are carried in a generally easterly direction before being deposited as acids. The nation's enormous consumption of fossil fuels, its reliance on motor vehicles, the existing shortages of oil and natural gas which will necessitate heavier reliance on coal as an energy source, and the expected increases in natural energy consumption all mean that the present acid precipitation problem in the Adirondacks may become further aggravated unless solutions are found.

The amount of pollutants, particularly sulfur, being introduced into the atmosphere by fossil fuel power plants can be controlled at the present time by two primary methods: 1) burning low sulfur fuels and 2) removing oxides from gases after combustion by means of flue gas desulfurization systems (scrubbers). Because low sulfur fuel is not available in sufficient quantities to serve the nation's power needs, the use of scrubber technology is necessary to control the acid precipitation problem. Various technologies have been tested to control nitrogen oxide emissions from motor vehicles.

The solution of the acid precipitation problem in the Adirondacks is directly related to the successful implementation of the existing provisions of the Federal Clean Air Act, administered by the United States Environmental Protection Agency. The Clean Air Act requires the protection and enhancement of air quality and establishes national ambient primary (necessary to protect health) and secondary (necessary to protect the environment and social and economic values) standards for various pollutants, including sulfur and nitrogen oxides that contribute in large part to acid precipitation in the Adirondacks. States must prepare State Implementation Plans that provide for the attainment of national primary standards by 1975 (or 1977 in some instances) and of secondary standards within "a reasonable time" by means of emission limitations on air pollution sources. The Environmental Protection Agency establishes regulations for pollutant emissions by new motor vehicles.

As part of the Energy Independence Act of 1975 the Ford Administration is proposing amendments to the Clean Air Act that could delay for a number of years the compliance schedules now required by the Clean Air Act for existing sulfur oxide sources to comply with emission limitations. These proposed amendments include relaxing the requirements for granting variances to compliance schedules, allowing certain existing plants to avoid existing requirements for installing scrubber technology until 1985, and relaxing the emission control requirements on existing power plants switching from oil or gas to coal. Furthermore, the Administration's proposal would delete the Clean Air Act's existing proscription against the significant deterioration of existing air quality, a proscription that is of vital importance to clean air areas like the Adirondacks.

Finally, the Energy Independence Act of 1975 would amend the Clean Air Act's existing schedules for reducing new car emissions by freezing for five years nitrogen oxide emission limitations to those required for new 1975 models. Any of these amendments have the potential of aggravating the acid precipitation problem in the Adirondacks.

RECOMMENDATIONS

The Adirondack Park Agency makes the following recommendations regarding the acid precipitation problem in the Adirondack Park.

1. National primary and secondary ambient air quality standards for sulfur and nitrogen oxides and State implementation plan emission limitations for sulfur and nitrogen oxides established under the Clean Air Act should be achieved at the earliest possible date to guarantee the protection of public health, the environment, and economic and social values.

2. Any relaxation in the Clean Air Act's existing provisions and in State implementation plan provisions relating to the control of sulfur and nitrogen oxides and to the maintenance of existing air quality should not be made without a full and careful assessment of the regional, environmental, economic and social impacts of such changes on rural areas, including the Adirondack Park, likely to be affected regardless of the distance from the sources.

3. Federal agencies, including the Environmental Protection Agency, state agencies and other entities should perform the research efforts necessary to fully assess the sources, formation, distribution, effects and short term and long term control of the acid precipitation phenomenon. New York State's Department of Environmental Conservation should expand its studies regarding this phenomenon and especially its existing research efforts within the Adirondacks. All of these research efforts should utilize the sensitive resources of the Adirondack Park as an "early warning system" to assess the impacts of acid precipitation on natural resources in the northeastern United States.

ENVIRONMENTAL DEFENSE FUND

July 1, 1981

TESTIMONY OF DR. MICHAEL OPPENHEIMER
BEFORE THE
SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

Mr. Chairman, my name is Dr. Michael Oppenheimer. I am the senior scientist in the New York office of the Environmental Defense Fund, a national non-profit organization dedicated to the preservation of the human and natural environment. I have recently joined EDF after ten years as an atmospheric physicist at the Harvard-Smithsonian Center for Astrophysics at Harvard University. The Environmental Defense Fund is a member organization of the National Clean Air Coalition, and I am speaking today as a representative of both EDF and the Coalition. I am also representing a group of environmental and labor organizations known as the CSHA/Clean Air Network.

Mr. Chairman, the issue I shall address is that of acid rain and the more general issue of the long range transport of air pollutants. In my remarks today, I shall pay particular attention to the scientific evidence on the causes of acid rain and their implications for an acid rain mitigation strategy. I will also outline the Coalition's proposal for dealing with this problem. My remarks on the effects of acid rain will focus on the human

444 Park Avenue South New York, New York 10016 ☎ 212-686-4191
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health hazards associated with this problem, an area which has received inadequate attention in recent discussions of acid rain.

It is the position of the National Clean Air Coalition that our understanding of the acid rain problem is sufficient to allow the development and implementation of a mitigation program. Here is an outline of the state of scientific understanding of the issue:

1. Precipitation over most of the eastern United States including the Southeast is abnormally acidic, ranging up to 20 times more acidic than normal on an annual average basis in parts of the Northeast. Acid rain also has appeared in the Rockies and is widespread in California. Rainfall in the East is primarily a dilute solution of sulfuric acid while in the West it is primarily nitric acid. There is no question that precipitation acidity substantially exceeds the natural background value.
2. Atmospheric loading of sulfur and nitrogen compounds is by far the major source of acid rain. In North America, atmospheric loading due to human industrial activity far exceeds that from natural sources. Approximately two-thirds of the total U.S. sulfur loading is from power plants, which also provide nearly 30% of the atmospheric loading of oxides of nitrogen. One third of all U.S. sulfur emissions originate in

the Ohio River Basin region power plants. Emissions from the transportation sector are another major source of oxides of nitrogen, providing over 40% of the national total. The relative dominance of sulfuric acid over nitric acid in eastern rainfall arises from the dominance of utility over transportation sources in the East, a situation which is reversed in the West.

3. The detailed mechanisms for the transformation of SO_2 and NO_x emissions into acid rain are not well understood, but there is absolutely no doubt that the transformation occurs. A general description of the process is the following: SO_2 and NO_x emissions from various sources are mixed into the lower atmosphere with moisture and other pollutants. Out of this chemical soup, various nitrates and sulfates are produced, among them nitric acid and sulfuric acid. Some of this chemistry occurs in the gas phase, while some also occurs in droplets and on particles. Some of this material is periodically washed out or rained out in precipitation, some remains as suspended fine particles, and some is deposited as dry acid material in a process called dry deposition. In some areas, dry deposition may be the main sulfate deposition mechanism. Thus, the acid rain and fine particle problems are intimately related.

4. Long range transport plays a vital role in the distribution of acid rain and fine particles about the country. Recent atmospheric modelling summarized in the Report of the U.S.-Canada Research Consultation Group on the Long Range Transport of Air Pollutants provides a general picture of this process. There is little doubt that most of the sulfate material reaching the Adirondacks, for instance, originates outside the Mid-Atlantic region, largely in the Ohio River Basin and the Upper Midwest. Furthermore, the contribution of U.S. sources to sulfates in the Canadian air is about equal to the contribution of Canadian sources to sulfates in the Canadian air.

There has been at least one study widely circulated which purports to show that local sources in the Northeast constitute the main source of sulfates in that region. I have carefully studied this report by researchers at PEDCo Environmental, Inc., commissioned by the Department of Energy, and find that the assumptions made on sulfur transformation rates are without basis and at odds with the best scientific evidence. Using more reasonable assumptions, even the model used in that report would tend to substantiate the findings of the Research Consultation Group that 70% or more of the sulfates transported to the Adirondacks originate outside the local region.

Further evidence of the significance of long-range transport comes from satellite photographs of pollution episodes combined with simultaneous ambient air measurements. These measurements show the large scale relationship of sulfates, ozone, TSP, and reduced visibility over the East. Trajectory analysis also has demonstrated that specific instances of atmospheric stagnation in the Midwest are correlated with enhanced sulfate levels at later times in the East. The reality and significance of long range transport is no longer in doubt.

5. Historical data on precipitation acidity over the last 20-30 years is not of high quality. However, these data do suggest a relationship between the construction of taller stacks and the spreading out of the region of abnormally acidic rainfall. Furthermore, the few measurements made in the 1930's indicate that rainfall in the Northeast was much less acidic at that time. A glance at a map of precipitation acidity in the U.S. clearly shows the intimate association of fossil fuel emission sources and abnormally acidic precipitation.
6. Arguments have been made that our lack of detailed understanding of the atmospheric and precipitation chemistry, and the absence of high quality precipitation trend data, prevent us from knowing what level of rainfall acidity reduction will result from a given level of emissions

reduction. However, the atmospheric models previously described have begun to help us unravel this difficult question. In a general way, measured and calculated atmospheric sulfate levels show a reasonable level of agreement. Given the assumptions that go into the models, it is now fairly clear that on an average basis, significant atmospheric sulfate reduction will indeed result from substantial SO_2 emission load reductions. Although the relationship of sulfate levels to precipitation acidity remains uncertain, we will not find ourselves in the position of reducing SO_2 loading without achieving significant air quality improvement. Furthermore, sulfur and nitrogen oxides, originating in manmade activities are the only identified large scale source of the observed acidification, so a long term load reduction strategy is bound to result in long term precipitation acidity reduction.

Finally, since dry deposition of sulfates may be comparable to wet deposition in terms of ecosystem acidification effects, the expected suspended sulfate reductions will clearly have direct impacts in terms of acidity reduction.

Let me now address the subject of health affects. It is particularly important that significant atmospheric sulfate level reductions can be expected to accompany an emissions reduction program, given the human health implications of atmospheric sulfates. Sulfates, which occur almost entirely as fine particles, and are not separately regulated as criteria pollutants, are shown in some studies to be more damaging to human health than sulfur dioxide. Direct epidemiological evidence exists of health damage at sulfate levels which correspond to the long range transport component of Northeast ambient sulfates.[1/] In other words, the interstate component of the sulfates may play a significant role in adverse health impacts of pollution. The long range transport component of sulfates creates potential PSD increment consumption and ambient air quality maintenance and attainment problems in some areas and has been the subject of litigation among various states. Further evidence for health effects can be inferred from studies which demonstrate or suggest that sulfates affect human health at considerably lower levels than SO_2 while recent clinical studies on the health affects of SO_2 show short term effects at much lower levels than previously suspected.[2/] Thus, we are concerned that the fine particles which are an integral part of the acid rain problem are causing widespread health damage in the Northeast. Some estimates of mortality associated with these particles exceed the level of tens of thousands of deaths per year.[3/]

Furthermore SO_2, the stack emission which is the original source of the sulfates, itself participates in long range transport in the Northeast. This component of SO_2 also contributes to ambient air standards maintenance and attainment problems in some areas, and thus potentially to health impacts. In addition, the synergistic health effects of sulfates, ozone and SO_2, all of which participate in long range transport, are little understood. What little evidence exists in this area is not encouraging.

The mitigation of health affects associated with long range transport of fine particles and other pollutants associated with acid rain should be given high priority in developing control strategies. My previous remarks on the atmospheric models indicate that an emissions abatement program would yield immediate benefits in terms of reduction of suspended fine particulate sulfates.

A second health related affect of acid rain pertains to the leaching of toxic metals into ground and surface drinking water systems subsequent to acidification. Enhanced levels of copper, lead, aluminum and mercury are already observed in drinking and non-drinking water systems in this country. In some cases, these levels exceed EPA standards. Such toxic pollutant levels are related to leaching of metals from pipes and watersheds due to progressive acidification of water by acid rain. In New York State, the gradual acidification of Hinckley Reservoir and the resulting increase in tapwater lead concentration to a level exceeding the standards has been documented.[4/] The leaching of copper and lead from the watershed itself is suspected as the cause of enhanced copper and lead levels, at or above the standard, in several other Adirondack water supply systems.[5/] The acidification of drinking water wells has also been documented in Ontario and in Sweden. I am extremely concerned that in several years, our water supplies may be threatened on a large scale basis by this process. Remedial action will be expensive and in some cases, such as private wells, impractical. Thus, leaching of toxic metals poses a second major health threat of acid rain.

Let me briefly discuss the wide range of impacts not directly related to health. The acidification of lakes and streams and the destruction of fish populations in the Adirondacks, in Ontario and in Nova Scotia, have been amply documented.[6/] A recent study of over a thousand lakes in Maine establishes a long term increase in average acidity.[7/] Another study reports the acidification of headwater streams in the New Jersey Pine Barrens,[8/] a pristine area now under Federal government protection. Reports of seasonal acidification come from regions as distant as Minnesota and West Virginia. We are witnessing the widespread increasing acidification of northeast ground and surface water with evidence of accompanying leaching of toxic metals, fish mortality and aquatic plant population alterations. The general sensitivity of the Northeast area to increasing acidification has been documented.

Concerns have also been voiced that other effects may eventually manifest themselves, including reduced forest and agricultural productivity of soils due to nutrient leaching accompanying acidification, reduction of nitrogen-fixing rates due to effects on soil bacteria, direct crop damage, and possible effects on climate. Some of these effects have been demonstrated under controlled conditions. Many of these effects are irreversible. At very least, they will be expensive to deal with. A thorough summary of these effects has been presented in the Interim Report of the U.S./Canada Impact Assessment Working Group established under the Memorandum of Intent on Transboundary Air Pollution.[4/]

The National Clean Air Coalition maintains that the scientific understanding of this problem, which I have outlined today, establishes a set of facts which demand immediate remedial action. The Coalition proposes the following mitigation strategy.

1. Congress should specify an initial total emission reductions goal and a year for attainment of that goal. Intermediate goals and years also may be specified. This step is also a recommendation of the National Commission on Air Quality.
2. Congress should identify the major sources to be involved in the mitigation program. The initial program should deal with eastern utility SO_2 sources, the major culprits in the eastern acid rain problem.
3. The allocation of emission reduction responsibility in order to achieve the initial goal should place the heaviest burden on the dirtiest sources, according to a Congressionally mandated formula.
4. All sources involved should submit a compliance schedule to EPA by a fixed date. This procedure properly assures

the design of a mitigation strategy for a problem at the Federal level which no one state can solve. However, states may opt to be involved in the enforcement of the compliance programs. The regulation of hazardous air pollutants under Section 112 and New Source Performance Standards under Section 111 currently operate in this fashion.

5. To permit the most cost-effective program, compliance may be pursued by the trading or selling of emission reduction obligations among the various sources throughout the eastern United States. Compliance may be achieved through any combination of enforceable emission reduction strategies.

6. Enforcement procedures for existing sections of the Act dealing with interstate and long range transport should be strengthened. Such changes will facilitate the mitigation of western stationary sources of pollution which contribute to visibility problems and potentially to acid rain in that part of the country, and to the mitigation of long range transport of SO_2, sulfates, ozone and toxic pollutants in the East. These pollutants are not only harmful on their own but participate synergistically in human health degradation.

7. EPA should commence a research and effects evaluation program as outlined in the Report of the National Commission on Air Quality, aimed at evaluating the progress of the initial mitigation strategy. EPA should promulgate a long term program aimed at further emission reductions beyond those mandated in the initial program and involving a broader group of sources.
8. Utility sources should be required to analyze the emission reductions which could be accomplished by investments in energy conservation and less-polluting alternatives to central station power generation.
9. Oil backout should be accomplished with no net increase in sulfur emissions.
10. EPA should be required to set strict New Source Performance Standards for industrial boilers within one year.
11. EPA should be required to fund commercial demonstration of improved technologies for controlling nitrogen oxide from fossil-fuel fired boilers, such as the Limestone Injection/Multistage-Burner (LIMB) technology.
12. Congress should establish physical limitations on stack heights in order to reduce long range transport of pollutants.
13. Enacted limits on mobile-source nitrogen oxide emissions should be retained.

14. To avoid disruptions in the coal mining industry, conditions should be included in the program as necessary to prevent loss of mining jobs.

We believe that this strategy is consistent with current understanding of the nature of the major sources of acid rain. The National Commission on Air Quality has estimated that a 7 million ton or 40% Eastern utility SO_2 emission reduction can be achieved by 1990 with a source emissions limit of 2lbs/MBTU funded by an average increase of less than 2% on eastern utility bills. The trading of emission reduction burdens will result in an even more cost-effective program at lower expense to utility customers. The targeting of larger reductions responsibility at the biggest sources may allow an SO_2 reduction of greater than 50% or about 10 million tons to be achieved before 1990.

In conclusion, I believe that the acid rain problem will serve as a model for our ability to deal in the future with even more complex environmental problems, such as the greenhouse effect and thermal atmospheric pollution. Like these problems, acid rain is interstate and international in nature, manifesting some of its worst potential aspects at a later time, fraught with complex technical issues, and requiring long range mitigation strategies. Our ability to deal with acid rain appropriately will bode well for our ability to deal with even more complex environmental problems in the future.

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TESTIMONY
OF
JACOB SHEINKMAN

Before Senate Environment & Public Works
Committee, July 1, 1981

Hon. Daniel P. Moynihan, presiding

Albany, New York - Citizens Panel

General Secretary-Treasurer, Amalgamated Clothing & Textile
Workers Union, AFL-CIO, CLC

THANK YOU, SENATOR MOYNIHAN, FOR INVITING ME HERE TODAY TO TESTIFY IN THESE HEARINGS ON THE CLEAN AIR ACT.

My name is Jacob Sheinkman and I am the General Secretary-Treasurer of the Amalgamated Clothing and Textile Workers Union. I am also a Vice-President of the Industrial Union Department of the AFL-CIO, the former Chair of the Jewish Labor Committee, the former Co-chair of the New York State Commission on Economic Development and am now serving as Co-chair of the Occupational Safety and Health/Clean Air Coalition of New York.

I mention these responsibilities to underscore my appearance as one not only of representation of labor and environmental concerns but also one of evincing a great concern for the economic viability of this state and the Northeast region. I am accompanied today by Dr. Michael Oppenheimer of the Environmental Defense Fund. Dr. Oppenheimer testified on EDP's and the Coalition's behalf as well today.

The member organizations of the OSHA/Clean Air Coalition are derived from the Industrial Union Department of the AFL-CIO membership comprising 56 national and international unions and the Clean Air Coalition composed of twenty major environmental organizations.

Their New York State constituencies have joined in a statewide network linking local organizations to each other and through our state linkage to similar structures across the nation.

We are a young coalition but are heavy with experience in our two issues of health in the workplace and in the community. Together labor and environmentalists, bring unique understanding and activism to preserving the protections of these Acts so necessary to our citizens.

Today, I wish to address most of my remarks to the dangers to New York State if the standards of the Clean Air Act are weakened.

Central to my comments today is the proposition that the notion of trying to achieve "balance" between clean air and a healthy economy is a misguided one. We in the labor movement have long heard that we must forswear worker health and safety and wage protection of the young, elderly, women and minorities to create jobs. But we have rejected that argument. We similarly reject the contention that we can have either clean air or jobs. We can have both.... both are compatible, both are essential, and both make especially good sense for New York.

Study after study shows that clean air helps to produce jobs and improve the economy. Chase Econometrics, Rynick Freeman of Brandwin College, and Barrett and Waddell of EPA's Research Triangle Park have at various times through the years studied the matter and their results remain the same. If only the impact of relocating capital from so-called productive purposes to cleaning up the air is considered, more jobs are created and the impact on inflation is barely significant. If further we consider the improved health, reduced days of work, reduced deaths and other benefits of clean air, the equation comes out decidedly in favor of vigorously pursuing a policy of cleaning up air pollution. One study of air pollution in New York by the New York Department of Air Resources in 1976 for example indicated that air pollution costs New Yorkers $1 billion dollars per year in increased health costs, working and materials damage -- costs that will be ended by cleaning up New York's air.

Compare that figure to the analysis of lung disease costs by the Public Service Laboratory of Georgetown University that totalled direct costs (hospitalization, treatment, medicine, cobalt, etc.) at $19 billion and with lung diseases' indirect costs of lost productivity at $49 billion. It is obvious that the nation would be saving money.

ACID RAIN - FINE PARTICLES AND LOCAL ENFORCEMENT

The failure to adequately control sulfur dioxide and nitrogen dioxide emissions have a specific negative impact upon New York's health and economy. In large measure this problem originates outside New

York Academy of Medicine Symposium on Environmental Effects of Sulfur Oxide and Related Particulates (1978), Page 1049, at least 73% of suspenced sulfates in New York City originate West of New Jersey. The presence of tnese high sulfate levels poses the two hazards in New York of deposits of dry acid materials and acid rain. According to testimony by Dr. Michael Oppenheimer (who accompanies me today) before the House Energy and Commerce Committee on June 23rd,

"1. Precipitation over most of the eastern United States is abnormally acid, ranging up to 20 times more acidic than normal on an annual average basis in part of the Northeast. Acid rain also has appeared in the Rockies and is widespread in California. Rainfall in the East is primarily a dilute of sulfuric acid.

2. Atmospheric loading of sulfur and nitrogen compounds is by far the major source of acid rain. In North America, atmospheric loading due to human industrial activity far exceed that from natural sources. Approximately two-thirds of the total U.S. sulfur loading is from power plants, which also provide nearly 30% of the atmospheric loading of oxides of nitrogen. Transportation is another major source of oxides of nitrogen providing over 40 plants. The relative dominance of sulfuric acid over nitric acid in eastern rainfall arises from the dominance of utility

> over transportation sources in the East, a situation which is reversed in the West."

I need not reiterate the morning's testimony on causes. Suffice to say beside the nitric acid and sulfuric acid, much of the suspended matter are fine particles and dry acid materials. Most of these particles are transported eastward along with the acid pricipitate, largely from the Ohio Valley to New York State and northward to Canada.

According to Dr. Oppenheimer's testimony, SO_2 which is a criteria pollutant, and which recent clinical studies indidate short-term health effects not much lower than previously suspected, itself, participates in long range transport as well.

According to various studies including those preseented at an acid rain conference in Toronto in 1980 by Dr. Leonard Hamilton of Brookhaven National Labs, this complex of pollutants leads annually to the loss of many thousands of lives in our region. According to the National Commission on Air Quality, there is an additional significant input of materials damage (up to several billion dollars nationally).

Many studies have indicated the possible impact of acid rain upon PH of lakes and resulting decline of fish and equatic plant life. The Adirondack Lakes devoid of fish has been attributed to the acid rain.

- The Fish and Wildlife Service has released the second report in a series concerning air pollution and acid rain. Entitled "Potential Impacts of low PH on Fish and Fish Populations", the report's purpose is to assist biolists and decision makers in assessment of ecological impacts and enable their effective input into the regulatory process

- Alarming evidence that more than 200 Adirondack lakes are sterile indicates a pervasive wildlife problem and provokes concern that acid rain is the cause. The Fish and Wildlife report's most important conclusion is that at less than 4.5 (moderately to higher acididic), few fish can survive.

- Steps to control acid rain are needed to alleviate the dangers to our wildlife and the resulting environmental and economic damage.

Other possible effects in New York include the possibility of future diminished forest productivity because of the leeching of nutrients (principally nitrogen) from soil (per "Simulation of Acid Precipitation Effects on Soil, Nitrogen and Productivity in Forest Ecosystems, J.D. Aber, et al, November, 1980), harm to New York's grape industry (study is underway at Cornell University

Experimental Station), possible damage to the apple and peach orchards and the leeching of toxic metals into water supplies from pipes and soils.

Because of the severity of the problem, the Clean Air Act should be strengthened to reduce fine particle pollution, long rante SO_2 transport, long range sulfate transport, and locally produced SO_2 and sulfate.

We therefore strongly urge that Congress retain in the several provisions now under attach from the Administration, special interest groups and some members of Congress and, in fact, strengthen the Act's provisions to prevent SO_2, fine particles and sulfate pollution as follows:-

(1) The requirement regarding strict deadlines for improving air quality (SIP deadlines) should be maintained lest motivation for reducing pollutants be eliminated.

(2) Achievement of improved air quality should be mandatory and not left up to the individual states' choice. We in the labor movement are very familiar with the concept of the "runaway shop" where industries seek locations for plants to avoid strict enforcement of health, safety, wage or tax laws. Removing EPA oversight and enforcement power over states would hurt, not help, the states since

industries could force states that that case to lower pollution cleanup goals in order to retain jobs.

(3) Coal conversions must require strict pollution control and should result in a net emission reduction. We are assured that coal can be burned with pollution control equipment at a net saving to consumer and utility operator. To allow coal conversion without such safeguards would add to SO_2, sulfate and particulate water pollution and would therefore hurt the health and welfare of New Yorkers.

(4) SO_2 and NO_x emissions from distant sources must be reduced to improve New York air quality. This reduction will require attention to existing power plants in the Ohio Valley according to the recent Ohio River Basin Environmental Study (ORBES) report.

PSD Provisions in the Act to Prevent Significant Deterioration should be maintained in their current form. As we indicated in recommendation (2) above regarding acid rain, failure to strictly enforce environmental regulation in other states will economically injure New York. In fact, failure to force PSD regulations in clean air areas would adversely affect all non-attainment areas economically. Meanwhile PSD areas would themselves suffer through increased pollution. No area benefits when PSD regulations are relaxed.

TRANSPORTATION

The relationship between transportation and air quality is clear and indisputable. Automotive air pollution is responsible for elevated carbon monoxide (CO) hydrocarbons, nitrogen dioxide (NO_x) and oxident levels (as measured by ozone). The effects of automotive pollution on health are equally clear cut. Several methods in the Clean Air Act and other laws have been devised to reduce this health impact including technology to reduce emissions from individual autos, transportation system management (TSM) and improved mass transit. Each of these approaches warrants this committee's support. In the case of TSM, highway legislation rather than the Clean Air Act must be amended to improve air quality -- car and van parking, better traffic enforcement to improve vehicle flow, park and ride lots, and exclusive bikeways or bus lanes are all methods for reducing automotive pollution that have been proposed to the Congress in prior year's testimony.

(of course TSM would also reduce traffic congestion and in this way help New York's economy. For example, the trucking industry has estimated traffic congestion costs $1 billion dollars annually. We hope that the committee will support traffic management and other TSM approaches when it considers highway legislation in the coming months.

-- Of more immediate relevance, we urge continued support of automotive emissions controls and promotion of mass transit. While some people have claimed that automotive controls initially may have reduced auto fuel economy and added to a car's cost (we contest even this claim) continued progress toward attaining the final automotive emission standards certainly will have little marginal impact. Attainment of these final standards will require use of technology, such as microprocessors to control engine and carburetor performance, that will improve fuel economy and improve the competitiveness of U.S. cars compared to Japanese and German models. Furthermore, the continuation of these standards does not place an undue burden on U.S. industry -- most cars already meet the final HE and NO_x standards and seventy percent of 1981 cars meet CO standard as do the Japanese and German.

-- We support the basic transportation needs (BTN) requirement of the Act created by Senator Moynihan and former Representative Holtzman. We believe that states such as New York should vigorously promote mass transit and that failure to do so should be correctly viewed as a failure to adequately develop a state clean air (SIP) plan. Members of our union rely upon the now decaying New York City transit system. As that system further decays and as fares rise, more and more workers are forced to resort to commuting by auto. The result is that our members must suffer twice -- once because of the transit system's decay and again because of the air pollution impact on their health.

We believe that EPA must exert strong oversight to assure that local transportation planning agencies meet the Act's mandate and that EPA must not merely provide pro-forma approval of transit plans developed pursuant to U.S. DOT local transportation planning requirements.

HEALTH

-- We strongly suppport vigorous enforcement of the current ambient air quality standards based on health only. We further recommend creation of a fine particle standard and promulgation of standards for hazardous pollutants.

Miners sometimes brought canaries into the mine to warn of impending gas buildups. In the same manner, workers at polluting factories today often serve as canaries for the population as a whole. Workers and their families additionally live nearby these factories. For these reasons, the Industrial Union Department of the AFL-CIO and the Amalgamated Clothing and Textile Workers Union are keenly aware of the need to reduce pollution to protect health through vigorous action to achieve the clean air health standards which have been established after long and careful study.

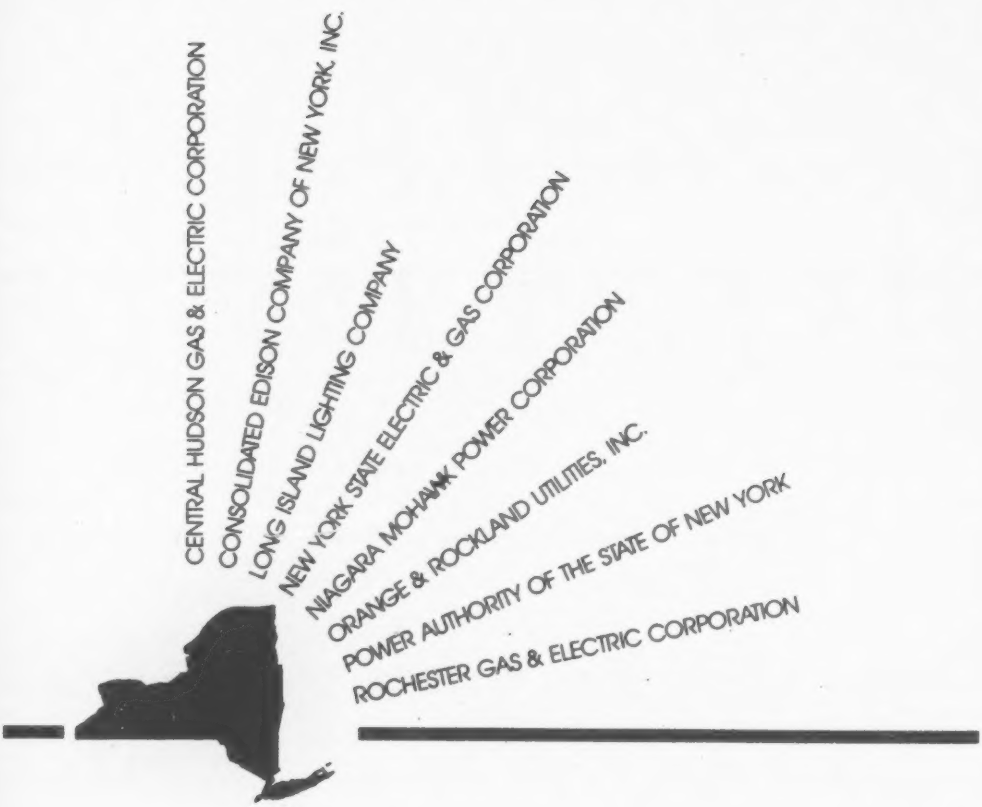
As I stated at the start of my testimony, we reject the notion that a healthy environment can only be achieved at the expense of jobs. These health standards will not cause a significant loss of jobs in any industry and many new jobs will be created in the pollution control industry.

-- We therefore reject the notion that a cost/benefit analysis should be applied in setting the health standards. Such an analysis is contained in the provisions applying the standards.

-- Finally, we contend that the health standards should be set with a sufficient safety margin to assure protection for the millions of elderly, children and individuals with respiratory difficulties who are more susceptible to air pollution health damage. To do otherwise would place an unfair burden upon the weak, elderly and infirm. We believe that this burden of paying for the effects of pollution should not fall upon those most in need of our help.

The New York Electric Systems
position on

Needed Changes to the Clean Air Act



CENTRAL HUDSON GAS & ELECTRIC CORPORATION
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
LONG ISLAND LIGHTING COMPANY
NEW YORK STATE ELECTRIC & GAS CORPORATION
NIAGARA MOHAWK POWER CORPORATION
ORANGE & ROCKLAND UTILITIES, INC.
POWER AUTHORITY OF THE STATE OF NEW YORK
ROCHESTER GAS & ELECTRIC CORPORATION

Introduction

Few would dispute the dependence of this nation, and New York State in particular, on foreign oil. Almost half of the nation's oil consumption is met by imported oil and consumers of electricity in New York State are substantially more vulnerable to interruptions in oil supply and escalations in the price of oil than consumers elsewhere in the nation. In 1980, nearly 60 percent of the generating capacity in the state was fueled by oil, as compared to 23 percent in the rest of the country.

The New York electric utilities are vitally concerned by the threat to price and supply posed by foreign oil dependence, as well as by the impacts which this dependence has on inflation, our balance of payments and our national security. Yet these companies recently have found their efforts to reduce oil consumption hampered by certain provisions of the Clean Air Act. Two of the methods which the New York electric utilities have identified as vital to their efforts to reduce the state's oil dependence — conversion of oil-fired plants to coal and the addition of new generating capacity — require state and EPA approval pursuant to the Clean Air Act. The Act's requirements together with a number of other requirements that result in little, if any improvement in air quality, make it difficult for the utilities to devise strategies to lower fuel costs. Clearly, the Act must be altered by Congress if New York State's efforts to reduce oil consumption and minimize the cost of electricity are to be successful.

While the pre-1977 Clean Air Act was reasonably effective in protecting air quality at manageable social costs, the 1977 amendments resulted in needless, complex, uncertain and cumbersome requirements. The New York State electric utilities and other utilities throughout the United States are, therefore, proposing modifications to the Clean Air Act which would remove unnecessary burdens, while maintaining protection of public health, welfare and the environment. These modifications do not require major changes to the present regulatory structure, but promise real returns in terms of economic and energy growth.

Modifications to the Clean Air Act are suggested in six major areas: State Discretion, Coal Conversions, Standards-Setting and Rulemaking Process, EPA Decision-Making, Overlapping or Unnecessary Technical Requirements and Interstate and Long Range Transport of Air Pollution.

State Discretion

The Clean Air Act intended that states, rather than EPA, be primarily responsible for administering the Act's requirements. However, federal requirements increasingly require prior EPA approval of any state actions. This EPA philosophy restricts the states ability to respond to and properly handle local situations. We believe that states should be given the authority to make reasonable adjustments of their implementation plans without EPA approval, as long as all statutory requirements will be met. EPA's role should be one of auditing the states programs to assure that federal requirements are being met and to arbitrate disputes where the states are not able to properly settle an issue. States, not the Federal Government, should be given the primary responsibility of implementing and enforcing the Clean Air Act.

States, while demonstrating continued progress toward long-term achievement of ambient air quality standards, should have the discretionary power to grant a permit that would allow the siting of a facility in any area if the expected environmental, social, economic and/or energy benefits significantly outweigh the air quality impact of a proposed facility. The granting of such discretionary powers will allow for a more balanced appraisal of a proposed facility which, while recognizing the need to improve air quality, also takes into account other local and regional needs.

To enable prompt response to fuel availability emergencies, states should also be granted the authority to issue suspensions to air quality regulations for the duration of the emergency.

(This discussion is directed toward Sections 101 and 110 of the Clean Air Act.)

Coal Conversions

The new source performance standards (NSPS), prevention of significant deterioration (PSD) and nonattainment provisions of the Act provide that a fuel conversion ordered by the Department of Energy (DOE) shall not be deemed a "modification" which triggers NSPS and PSD review. Since only DOE-ordered fuel conversions are presently exempted from NSPS, voluntary coal conversions would be required to install scrubbers which could be uneconomical and impractical, since existing plants were not designed to accommodate flue gas desulfurization equipment. In order to facilitate any coal conversion, the Act should make it clear that neither voluntary nor mandatory coal conversions are "modifications" for the purposes of the Act. Indeed, voluntary coal conversions should be given the same preferential treatment in meeting air quality requirements as are given federally-ordered conversions.

EPA's interpretation of the Clean Air Act precludes the use of supplementary controls, including fuel switching or load reduction during unfavorable meteorological conditions as a means of maintaining national ambient air quality standards. EPA maintains that such controls would be "unenforceable." This interpretation is technically unsound and prevents the use of economically attractive methods of converting a power plant to coal. The Act should specifically permit the use of such supplementary controls at facilities that are reconverted to coal.

(This discussion is directed toward Sections 111, 123 and 160 of the Clean Air Act.)

Standards-Setting and Rulemaking Process

The New York State electric utilities support the concept of air quality standards as a means of identifying the level beyond which public health may be affected. However, setting primary standards using only a single criterion, public health, assures that the EPA Administrator will err on the side of setting more stringent standards than are needed to reasonably protect public health. Our objective is to strengthen the standards-setting process, making it more reasonable and cost-effective. This involves several revisions to the Clean Air Act.

The process and basis by which a primary standard is established must also be altered so that health risk assessment and cost/benefit tests are considered by EPA when establishing standards. Similarly, secondary standards which are not health-related must be viewed as guidelines or goals which the states may set, depending on local circumstances.

In developing rules to implement the Clean Air Act, EPA must typically deal with issues of a complex and novel nature, which have significant and widespread impacts. Given the nature of EPA rulemaking, it is critical that the EPA weigh all alternatives, taking into account economic, energy and environmental considerations. However, the Act as now written prevents such consideration. The New York State utilities are proposing that all regulations, prior to proposal, be evaluated by an independent scientific body to assure all pertinent factors have been weighed, the regulation is cost-effective and in the best interest of the country.

(This discussion is directed toward Sections 108 and 109 of the Clean Air Act.)

EPA Decision-Making

Extreme frustration and difficulty are experienced by the electric utility industry, as well as others, in obtaining decisions and regulatory approvals from EPA. Recent experience has shown that nine months to a year is the minimum time in which EPA can approve most actions and, in some cases, approval has taken in excess of two years. In addition, frequent changes in criteria and policies cause uncertainty as to the outcome of the approval and generate further delays. It is proposed that a statutory timetable be included in the Act for all phases of EPA decision-making processes. It should be noted that the New York State Legislature, in 1977, passed a bill incorporating this concept that statutorily establishes deadlines for agency actions on environmental permits (Article 70, New York State Environmental Conservation Law).

(This discussion is directed toward a new section to be added to the Clean Air Act.)

Overlapping or Unnecessary Technical Requirements

The Clean Air Act contains a staggering variety of technical requirements on new or modified sources of pollution. While these requirements may only result in minimal differences in environmental benefits, they add up to significant additional costs, delays and uncertainty in planning new facilities.

These requirements may even cause a deterioration of present air quality by encouraging the additional use of less efficient, more costly, more polluting, older facilities.

Our objective is to simplify current requirements by proposing changes to the PSD program, new source performance standards requirements and tall stack provisions. These changes will yield identical environmental benefits to the present situation in a drastically reduced time frame and at a significantly lower cost. The unpredictable nature of the present BACT provisions renders rational system planning much more difficult since costs and the nature of equipment and fuel cannot be known with precision early in the planning process. We believe that for sources where new source performance standards have been established, there should be no best available control technology review, thus allowing for both simpler and quicker permit reviews and flexibility in how the applicant meets the standards. For cases where new source performance standards have not been established, best available control technology review would be used. In addition, a facility should be allowed to meet NSPS requirements by "bubbling" the emissions from the new unit with those from existing units, as long as the total emissions from the facility do not exceed what would have been emitted if the "bubbling" option were not available. This approach would allow greater flexibility, as well as cost and energy savings, without any increase in emissions or deterioration of existing ambient air quality.

Severe practical problems are caused by the complexities and uncertainties in meeting the detailed PSD requirements. In a recent report, EPA's Regional Administrators have concluded that the PSD program has resulted in an extended, complex permit process which has done little to improve air quality. A solution for simplifying and streamlining the permitting process is to restrict the requirement for PSD review to pristine (Class I) air quality areas where the rationale for PSD truly applies. In non-Class I areas, preconstruction review should be sufficient to maintain ambient air quality standards.

The original purpose of the tall stack rulemaking was to eliminate tall stacks as a technique for maintaining air quality standards near a plant. Because of the requirements imposed by EPA's new source performance standards, new sources must now meet strict emission limitations. Therefore, this requirement is now unnecessary and counterproductive and this section should be repealed for new sources.

The use of mathematical models to determine impacts and compliance of facilities as practiced by EPA makes it impossible for utilities to devise strategies to lower fuel costs. Certain models are accepted by EPA regardless of their validity to specific applications. While such models may be valid predictive tools in simple situations, such models will either over or under predict ambient concentrations in most situations. EPA does not use objective criteria in evaluating the applicability of non-EPA endorsed models, which often are better representations of actual conditions.

To move toward resolving the serious problems which result from these inaccurate tools, EPA should be required to use measured data to the maximum extent possible when determining impacts and compliance of facilities. Models should be used only when absolutely necessary and then made as realistic as practicable — as opposed to the extreme "worst case" assumptions now practiced by EPA when performing air quality studies.

(This discussion is directed toward Sections 123, 160, 161, 162, 163, and 169 of the Clean Air Act.)

Interstate and Long Range Transport of Air Pollution

The interstate and long range transport of air pollutants is an extremely complex problem which is inadequately addressed in the Act. The Act's inadequacies on this issue are apparent by the charges and counter-charges between and among states as to the sources of a state's air pollution. There are competing interests, each having some merit (e.g., the preservation of fish life in the Adirondacks vs. the needs of industry and the economy of the Ohio Valley). These are clearly areas which should be addressed by the Federal Government; and a comprehensive program fair to all, developed. The Act currently attempts to address interstate pollution by ensuring that one state's implementation plan is adequate to protect the NAAQS in another state. Despite the unequivocal language of the Act, EPA and several states contend that this protection extends to more stringent state-adopted air quality standards. To avoid any misinterpretation, the Act should be amended to preclude EPA from considering state-adopted air quality standards when addressing interstate pollution abatement.

Acid precipitation is a natural phenomenon that is poorly understood by the scientific community; but some things are known: that the acidity of precipitation does not seem to be increasing; that effects on crops and trees are not discernible, that human health does not seem affected, that the formation and distribution of acids is very complex, and that the acidification of waterbodies in certain areas is slowly occurring. The point is, there is time to scientifically investigate the phenomenon, sort out the choices for action and pursue the course(s) of action that are reasonable and will be effective in preventing or curing the environmentally harmful aspects of the phenomenon. The Moynihan-sponsored Acid Precipitation Act of 1980 establishes a program for the scientific research so that upon a better understanding of the facts, appropriate action can be taken. Changes to the Clean Air Act that "does something" to control acid precipitation is inappropriate since we do not understand the "ailment" enough to prescribe a "cure." Let the present statutory program address this issue and do not amend the Clean Air Act to deal with it!

(This dicussion pertains to Section 126 of the Clean Air Act.)

Conclusion

Implementation of these recommended changes to the Clean Air Act will significantly reduce the regulatory burden now being faced by New York's electric utilities under the current law. The benefits of such changes will accrue to the citizens of New York by dampening the effect of spiraling energy costs and, as a result of coal conversions, make the State less dependent on foreign oil.

NECESSARY CLEAN AIR ACT AMENDMENTS AFFECTING STATIONARY SOURCES

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A Position Paper
on
Necessary Clean Air Act Amendments
Affecting Stationary Sources

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I. INTRODUCTION AND SUMMARY

During the 1970's, we greatly increased our knowledge and understanding of:

- air quality problems;
- air pollution control capabilities;
- the economic, energy, environmental and other social costs of air pollution control programs; and
- the degree to which health standards are scientifically based.

The 1970 Amendments to the Clean Air Act

- improved air quality significantly in most of the nation; and
- imposed substantial costs on consumers.

However, in the three years since the passage of the 1977 Amendments to the Act

- air quality improvements which have resulted from the new, more stringent requirements have been marginal;
- social costs of meeting the new requirements are substantially greater than those of the pre-1977 requirements;
- these additional costs have either contributed to, or will exacerbate, the nation's continuing productivity problems, high rates of inflation, dependence on oil imports, and higher unemployment rates. These substantial, incremental social costs are expected to be far greater than the resulting social benefits.

While the pre-1977 implementation of the Clean Air Act proved reasonably effective in protecting air quality at manageable social costs, revisions in the Act are now needed to

- remove the most unreasonable and socially unjustifiable requirements added by the 1977 Amendments; and
- fine-tune the remainder of the Act to reflect the knowledge and experience acquired in the past decade in order to make it socially cost-effective.

Substantive problems with the Act include the following:

1. A number of provisions have been interpreted by EPA and the courts as restricting EPA's authority to consider the economic, energy, environmental, and other social effects of proposed regulations. These restrictive interpretations have resulted in unduly expensive regulation, continued reliance on foreign oil, and, in certain locations, may even delay improvements in air quality by delaying the construction of new plants that are required to meet very stringent emission limitations.
2. Certain provisions of the Act restrict the discretion of local authorities to account for specific local concerns, thereby limiting the ability of states and local governments to respond in the most effective manner to local circumstances. While minimum federal standards may be necessary in some areas, EPA's affirmative role in reviewing and approving each state-developed requirement has resulted in confusion and delay, and has tended to create an adversarial relationship between the states and EPA.
3. New sources are subject to numerous, overlapping regulatory requirements. These include primary and secondary ambient standards, new source performance standards (NSPS), best available control technology (BACT), prevention of significant deterioration (PSD) increments, visibility requirements, and others. PSD increments create tremendous uncertainty as to future requirements for all facilities and impose artificial

and arbitrary barriers to construction of new facilities. The numerous additional overlapping requirements also create unacceptable uncertainty in the planning of new facilities.

4. The state of knowledge concerning certain regulatory topics, such as the so-called "acid rain," "long-range transport," and "visibility" phenomena, is woefully inadequate. Leaping toward premature regulatory programs before the necessary information is available can lead only to ineffective, and unnecessarily expensive, regulation.

Nine changes, all of major importance, are needed to resolve these problems. These changes are to

1. Mandate consideration of economic, energy, environmental and other social effects of proposed and final regulations.
2. Fashion reasonable new source requirements that will provide special protection for unique and pristine federal lands; eliminate the PSD increments in order to remove socially undesirable deterrents to the construction of new plants; and simplify, streamline, and expedite the pre-construction permit issuance process.
3. Remove the visibility-based regulatory requirements, and require that further visibility regulation of existing sources be considered only after the necessary studies are performed to fill the gaps in our knowledge concerning visibility.
4. Expedite agency decisions on state implementation plans (SIPs), and reaffirm Congressional intent to let the states, rather than EPA, determine
   —the means of attaining federal ambient air quality standards through SIPs, and
   —reasonable deadlines for attainment of secondary air quality standards based on a balancing of local concerns, including the economic, energy, environmental, and other social effects of implementing the standards.
5. Eliminate the uncertainty, delay and waste of manpower resulting from multiple, case-by-case, technology-based BACT and "lowest achievable emission rate" (LAER) emission requirements by providing a single standard of NSPS where such standards have been established.
6. Enable meaningful and prompt response to energy emergencies by allowing "temporary emergency suspensions" of SIP requirements when severe disruptions in the energy market occur; by eliminating the arbitrary four-month time limit on such suspensions; and by giving the states greater authority to act where all that is required is a short-term suspension which is not likely to affect the primary ambient standards.
7. Allow needed flexibility to encourage conversion of oil burning units to coal by (a) exempting voluntary coal conversions from new source review; (b) authorizing EPA, under section 113(d), to allow the temporary burning of coal to ascertain the implications of a proposed coal-conversion, as long as primary ambient standards are met; and (c) liberalizing the section 110(f) provision for "temporary emergency suspensions" of SIP requirements.
8. Make new source review and regulatory development more realistic by eliminating unnecessary use of air quality modeling, by requiring the use of probabilistic techniques in evaluating modeling results, and by requiring that any standard set reflect reasonable estimates of the duration and frequency of occurrence of the effect against which the standard is designed to protect. And
9. Make procedural changes in the Act in order to (a) strengthen the scientific and other

factual bases for Agency decisions, and (b) provide for more searching judicial review of Agency actions.

These changes do *not* require a radical restructuring of the Clean Air Act. The present requirement that public health be protected against adverse effects would not—and should not—be changed. However, when establishing requirements that go beyond protecting against adverse health effects, the solutions listed above, and discussed generally below, will insure that the economic, energy, environmental, and other social costs of Clean Air Act regulation are considered. The suggested changes are designed to introduce needed flexibility into the regulatory process, to reduce the uncertainty which renders more difficult the planning and operation of new and existing facilities, and to speed up the administrative decision-making process.

In view of the complexity of the Clean Air Act and the wide variety of conditions throughout the United States, the effect of these changes will vary from region to region. Thus, individual states or regions, and electric utilities and citizens in those states and regions, will have their own priorities among the issues discussed in this paper. The priorities in this paper are presented from the perspective of the nation as a whole.

II. PRIORITY CHANGES

A. Consideration of Costs and Benefits and Cost-Effectiveness Analysis

In developing rules to implement the Clean Air Act, EPA must typically deal with issues of a complex and novel nature, which have significant and widespread impacts. Given these aspects of EPA rulemaking, it is critical that the Agency fully consider the economic, energy, environmental, and other social implications of its actions. The operative provisions of the Act, however, preclude, or at best inhibit, fulfillment of this objective. Section 317 of the Act (which is a reporting requirement) should be amended to require that the potential benefits of *any* proposed regulation, including ambient standards under section 109 of the Act, be identified and compared with the benefits and costs of alternative regulatory solutions. Where the Agency is setting (a) technology-based requirements, (b) "welfare" or "aesthetic" (not related to human health) based ambient standards or emission limitations, or (c) the margins of safety *beyond* levels requisite to protect the public health from adverse effects, the Agency should also be *specifically required* to choose the requlatory alternative which reflects the best balance among the competing factors.

Other sections of the Act should be amended to clarify or conform them to this general objective:

1. Primary Ambient Air Quality Standards and Standards for Hazardous Air Pollutants. Experience with standard setting under sections 109 and 112 of the Act has made it apparent that, as presently written, the Act provides no criteria to guide the EPA Administrator in determining how far below the level of adverse effects on public health a primary ambient air quality standard or a hazardous emission standard should be set. In order to rationalize the system of public health standard-setting, *the margin of safety* below the level necessary to protect against adverse public health effects should reflect consideration of a broad range of factors, including comparative risk assessments and economic, energy, environmental, and other social consequences of alternative margins of safety. A general provision should be added to the Act requiring peer group review of the technical and other scientific data used to formulate the standard, and specifying the composition and functions of such review groups.

2. Secondary Ambient Air Quality Standards. In setting secondary (welfare-based) standards, EPA in the past (a) has made little effort to ascertain or quantify social costs, (b) has generally overestimated benefits, and (c) has not attempted to balance these considerations for various alternative secondary standards. Congress should mandate that EPA ascertain accurately and balance social costs and benefits in setting secondary standards. At the same time, EPA should be required to recognize that Congress intended to permit each state to evaluate the indirect, as well as direct, costs of alternative attainment dates for compliance with EPA's *secondary* standards and to apply cost-benefit methodology to determine whether current or future deadlines for compliance with such standards within its boundaries are "reasonable."[1]

3. New Source Performance Standards (NSPS). In 1977, Congress amended section 111 to require that NSPS for fossil fuel-fired stationary sources include a percentage reduction requirement in addition to an emission ceiling. The stated purpose for this additional requirement was to avoid dislocation of the market for Eastern and Midwestern high sulfur coals. The recent rulemaking to set NSPS for powerplants has shown that the percentage reduction requirement is not needed to achieve this objective. Indeed, it was shown that an overly stringent percentage reduction requirement of 90 percent removal for higher sulfur coals can actually defeat this objective by greatly increasing the technological, economic, and enforcement risks of trying to scrub the higher sulfur coals. This rulemaking also showed that setting a percentage removal standard in addition to an emission ceiling does not produce the most cost-effective regulation of new sources. Congress, therefore, should eliminate the percentage reduction requirement from section 111(a)(1)(A)(ii) of the Act. This deletion, coupled with the changes in section 317 recommended above, will assure that the Administrator can choose the best NSPS from a cost-benefit standpoint.

In addition, a utility should be allowed to meet a NSPS by "bubbling"[2] the emissions from the new unit with those of other units, as long as the total net emissions from the units in question over the life of those units do not exceed what would have been emitted if the bubbling option were not available. This approach would allow greater flexibility, as well as cost and energy savings, while effecting at least the same long-term reduction in emissions as if the bubbling option were not available.

B. Prevention of Significant Deterioration (PSD)

The PSD program suffers from a number of generally acknowledged flaws. For powerplants, the most important are the delays associated with the preconstruction review process and the uncertainty created through the potential for ever-shifting regulatory requirements resulting from the court's interpretation of the PSD "increments" as tertiary ambient air quality standards.

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[1] When Congress considered the 1977 Amendments during the period 1975 to 1977, it recognized that ambient concentrations of some criteria pollutants have natural as well as "man-made" origins. Attempts in the past to parse these natural contributions to ambient air quality levels and to focus regulation only on controllable contributions to ambient concentrations of a substance have been *ad hoc* and sporadic. The problems presented by natural sources of pollutants provide an additional reason why legislative action is required with respect to the balancing of economic, energy, environmental and other social factors in statutory provisions applicable to ambient-based standards and limitations, and to the setting of realistic deadlines for attainment of ambient standards. Given the uncertainties affecting the identification and modeling of natural sources of emissions, such emissions should also be discounted in modeling analyses and compliance determinations, in accordance with the intent of Congress.

[2] The "bubbling" of emissions refers to the practice of treating the emissions from several sources as if those emissions were produced by a single source for purposes of defining and determining compliance with emission standards.

The general effect on the electric utility industry has been and will be to delay the construction of new, more efficient, and less polluting coal-fired plants, thus forcing continued dependence on old oil-fired and old coal-fired units. The PSD increments also restrict coal conversions, and create an administrative nightmare through the complex system of air quality bookkeeping which is required to track increment consumption. These factors adversely affect the economy, the environment and the nation's efforts to curtail oil imports. For other "non-regulated" industries which have the options of not building new plants or not building them in the United States, it is our perception that the principal effect of PSD on those industries has been to decrease overall construction of new plants within this country.

The PSD "increments" are widely perceived to be arbitrary in their effect and unnecessary in view of other Air Act requirements that new sources must meet (*e.g.*, NSPS and ambient standards). The best way to solve the problems with the PSD system is to eliminate the PSD increments but maintain preconstruction review to assure compliance with NSPS, ambient air quality standards, and any special requirements for unique and pristine federal lands. The current ambient standards assure protection of the public health and welfare, and the NSPS minimize emissions from new sources. If special protection is provided for unique and pristine federal lands through new site-specific constraints, any such requirement should provide for a waiver where the owner of the source [illegible] constructed can show that construction is justified by a balance of economic, energy, environmental and other social factors.

C. Visibility

Section 169A of the Clean Air Act grants EPA the authority to prescribe regulations for controlling the impacts of *existing* sources on visibility in federal Class I areas. EPA has developed visibility regulations even though it admits that the state of visibility monitoring and modeling is inadequate to permit rational implementation of its visibility protection program. In addition, EPA has construed section 169A to permit it to expand the scope of the visibility program to include protection of views of "integral vistas" from federal Class I areas and to regulate new sources, even though such sources are specifically subject to regulation under section 165(d) of the Act. In order to solve these problems, the regulatory requirements of section 169A should be removed and, following the precedent of the recent Moynihan bill on acid precipitation (Title VII of P.L. 96-294), further consideration of visibility regulation of existing sources should be considered only after the necessary studies are performed to fill the gaps in our knowledge concerning visibility.

D. State Implementation Plans

State implementation plans (SIPs) are the basic tool used in implementing EPA's air quality standards and other national regulations. The SIP regulatory system was intended to provide states with flexibility to implement national requirements in a manner which reflects local needs. Under section 110, EPA must affirmatively approve each and every SIP revision developed by a state. The experience with section 110 over the past years has demonstrated that EPA cannot respond in a timely and adequate fashion to each and every SIP revision. This results in substantial delays and uncertainty about the status and effect of SIP requirements. There have also been instances where EPA has simply tried to "second guess" the state on what is essentially a judgmental choice as to what is the best balance of local concerns.

These problems can be cured by revising section 110 to re-emphasize Congressional intent that the states have primary responsibility for SIP development, subject to the basic federal criteria in section 110(a)(2) of the Act. EPA's authority to veto SIP revisions would be exercised only if EPA found that the particular provision in the SIP was "substantially inadequate" to attain the forcing federal criteria. This test of "substantial inadequacy" has been a part of the Act since 1970, but EPA has largely ignored this command in reviewing and approving SIPs. To insure that states have primary responsibility for SIP development, amendments to the Act should provide that (1) EPA may participate in state SIP rulemakings; (2) SIP changes become effective when effective under state law; (3) EPA can veto the change within 60 days after its promulgation, but only for legal and factual grounds raised in the state SIP rulemaking; (4) in the event of an EPA veto, the state SIP remains in effect until EPA promulgates an alternative SIP provision; and (5) in any appeal of the EPA veto, the burden is on EPA to show the legal and factual basis for its veto and that, in the case of any alleged factual deficiency, the state's finding is without substantial support in the rulemaking record.

E. Multiple Technology-Based Standards

New Source Performance Standards (NSPS) must reflect a level of emissions control characteristic of "best adequately demonstrated technology." EPA has traditionally set NSPS at very stringent levels to reflect the latest and continuing developments in control technologies. Given the way in which NSPS are set, it makes little sense, where NSPS have been established, to require additional and separate case-by-case technology limitations to be prescribed under other provisions of the Act. Much uncertainty could be eliminated if the Act were amended to provide that "best available control technology" (BACT) and "lowest achievable emission rate" (LAER) are deemed to be equal to any applicable NSPS.

F. Emergency Exemptions

In order to enable meaningful and prompt response to energy emergencies, the variance provision in section 110(f) of the Act should be expanded to allow the granting of "temporary emergency suspensions" of SIP requirements where there exists a disruption in the energy market which creates a substantial likelihood of significant, adverse economic impacts on consumers generally or on particular classes of consumers. In addition, the four-month limitation on temporary emergency suspensions imposed by sections 110(f)(3) and (4) should be repealed. Such a limitation is unrealistic in light of the unstable conditions in the Middle East and elsewhere threatening our oil imports. Finally, the procedure for obtaining a temporary emergency suspension has proved to be cumbersome and fraught with delays. In order to streamline these procedures, the state should be authorized to grant emergency suspensions for a limited period of time without a finding by the President of a national energy emergency, as long as the findings required by section 110(f)(2) are made and the source demonstrates that a violation of the primary ambient standards is not likely. In the event that the President has been requested to find that a national energy emergency exists, the state-authorized emergency suspension should remain in effect pending the decision of the President. The role of EPA in disapproving such a suspension should be limited by requiring the EPA Administrator to show that the suspension decision of the state is not supported by substantial evidence.

G. Coal Conversions

The NSPS, PSD and nonattainment provisions of the Act provide that a fuel conversion ordered by the Department of Energy (DOE) shall not be deemed a "major modification" which would trigger new source review. Since only DOE-ordered fuel conversions are covered by these requirements, however, many *voluntary* fuel conversion candidates are subject to new source review. Subjecting such sources to these new source requirements will in most cases tend to discourage voluntary conversions. To solve this problem, the new source provisions of the Clean Air Act should make it clear that neither voluntary nor mandatory coal conversions are major modifications for purposes of the Act. In addition, in order to facilitate identification of the economic and environmental implications of coal conversions, section 113(d) of the Act should be amended to authorize the issuance of administrative orders which would allow a 1 to 2 year variance to permit the temporary burning of coal or high sulfur oil at a facility considering coal conversion, as long as primary ambient standards are met. The authorization of such "test burns" would facilitate coal conversions. The revisions to section 110(f) suggested in section F above will also encourage coal conversions.[3]

H. Ambient Air Quality Modeling, Measurement Techniques, and "Exceedances"

Air quality models are mathematical techniques for estimating the effects of emissions from individual and multiple sources on the air quality of the surrounding area. They are used extensively to develop regulations and to determine compliance with air quality standards and PSD increments. While such models are less prone to error in a situation where there is flat terrain, where the modeled pollutant is stable, and where the averaging time is a month or a year, such models will overpredict or underpredict ambient concentrations in most other situations. EPA's practice to date has been to perform air quality modeling using multiple "worst case" assumptions. This practice results in serious overestimation of air quality impacts, thus restricting economic growth that could otherwise take place.

To move toward resolution of the serious problems which result from the use of these inaccurate tools, Congress should eliminate from the Act those provisions that require the use of modeling but which do not add significantly to the protection of the public health and welfare. In particular, section 123 of the Act (requiring modeling using artificial stack height assumptions) and the PSD increment program should be eliminated. The use of monitoring data in regulatory programs should be encouraged to the maximum extent possible, where there are *bona fide* needs for such data, and where the use of models alone is subject to serious uncertainties.

Since EPA has ignored Congressional intent as reflected in the legislative history of the 1977 Clean Air Act Amendments, a statutory requirement should be added which expressly requires the use of the most realistic—as opposed to extreme "worst-case"—modeling assumptions. Probabilistic techniques should be used by EPA in evaluating modeling results and, if possible, modeling predictions should be compared with monitoring data.

The present mechanistic application of the enforcement criterion that the "second exceedance" of a standard constitutes a violation improperly portrays air quality and the possible effects of exceedances on health and welfare. It also fails to take into account the difficulties inherent in accurately predicting or monitoring ambient concentrations of a substance and the contributions of natural sources to such concentrations. EPA therefore should be directed to consider both the duration and frequency of exceedances in determining whether a violation of applicable federal standards has or would occur. These factors should be weighed both for exceedances predicted by modeling and those recorded by monitoring.

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[3] Finally, section 163 of the Act provides that a state may exclude from increment consumption for up to five years emission increases attributable to DOE-ordered fuel conversions. If additional emissions cause an increment to be violated after this five-year period, the converting source would be required to install additional control technology. The uncertainty inherent in this provision can only discourage coal conversions. If the PSD provisions are not amended to eliminate the increments entirely, the Act should be amended to exclude *permanently* from increment consumption those emission increases associated with *any* (voluntary or mandatory) fuel conversion.

I. General Administrative Provisions of the Act

1. Review of Technical Data. Because of the complex and technical nature of the information which EPA must evaluate in formulating rules, EPA is currently required to consult with a variety of technical advisory groups in developing a data base for new regulations. The role of such groups and the weight to be given their recommendations is not always clear. To clarify the function of these groups, a general provision should be added to the Act requiring peer group review by particular committees of the technical and other scientific data used to formulate regulations. The comments of such groups should be placed in the rulemaking docket as soon as they are received by the Agency. EPA should be required to take into account the recommendations of such advisory committees and to explain any rejection of those recommendations in its statement of basis and purpose. In any appeal, EPA's findings must be shown by the Agency to have substantial factual support in the rulemaking record.

2. Judicial Proceedings. The standard of appellate review in section 307(d)(9) should be revised to incorporate the changes in section 706 of the Administrative Procedure Act proposed in S.67 (the "Laxalt, Simpson, Bumpers Bill") concerning the degree of deference to be given the decisions of administrative agencies.[4] In addition, section 307(b)(1) of the Act now vests exclusive jurisdiction in the Court of Appeals for the District of Columbia Circuit for review of nationally applicable EPA regulations. The Clean Water Act does not impose this restriction on the jurisdiction of the other courts of appeals. In the context of that Act, the Supreme Court has applauded "the wisdom of allowing difficult issues to mature through full consideration by the courts of appeals" because it affords the Supreme Court the benefit of more extensive consideration of complex issues at the appellate level. *See DuPont v. Train*, 430 U.S. 112, 135 (1977). Furthermore, the most recent and thorough congressional discussion of exclusive D.C. Circuit jurisdiction occurred when the Senate rejected in 1977 an amendment to the Clean Water Act which would have given the D.C. Court exclusive jurisdiction. The debates on this amendment provide additional support for a change in the Act which would give each of the courts of appeals jurisdiction to review major EPA regulations. The Clean Air Act should be conformed to the Clean Water Act.

III. OTHER DESIRABLE CHANGES TO THE CLEAN AIR ACT

The above issues are all of critical importance to making the Clean Air Act a more effective tool for air quality regulation. In reviewing these issues, however, Congress should consider a variety of other possible revisions which would render regulation under the Clean Air Act more efficient and less time consuming.

A. Enforcement and Delayed Compliance Penalties

The basic problems with the provisions of the Clean Air Act addressing noncompliance with emission requirements — sections 113 and 120 — are that they are duplicative and, in critical respects, unreasonably stringent in view of the nature of the underlying regulatory requirements. To solve the problem of duplication, section 120 of the Act should be *eliminated*, since, under section 113, civil penalties may be assessed based on all the factors listed in section 120 as well as other factors. Second, in order to make the section 113 enforcement provisions of the Act consistent with the basic division of federal-state authority envisaged by Congress in the Act, the states should be given primary enforcement responsibility by precluding federal enforcement where a state has taken, or is taking, action. Finally, criminal penalties should be limited to the situation where a source owner or operator knowingly makes false statements or tampers with monitoring devices with the intent of generating false or misleading information.

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[4] These changes in section 307(d)(9) would (1) confirm that in appeals of Agency rules where important issues of fact are raised, the Agency's findings must have "substantial support" in the rulemaking record; (2) provide that Agency jurisdiction must be spelled out in the statute or supported by other clear evidence of legislative intent; and (3) as to other questions of law, provide that there is to be no presumption in favor of or against the Agency's decision.

B. Rulemaking Procedures

In order to improve the effectiveness of EPA rulemaking, section 307 of the Act should be amended (1) to provide that rulemaking deadlines specified in the Act are not absolute and can be extended by the Administrator for good cause; (2) to require that all Clean Air Act rulemakings be subjected to section 307(d) procedures; (3) to clarify the nature of rulemaking procedures afforded; (4) to require that rulemaking hearings be conducted in a fashion to afford the public a meaningful opportunity to participate and to learn the position of the Agency and its experts; and (5) to require EPA, when it promulgates final rules, to list all issues which must be appealed within 60 days of promulgation.

C. Fugitive Emissions and Naturally Occurring Particulates

This issue is of major regional significance. EPA currently requires that "fugitive emissions" associated with a new source be modeled in evaluating the impact of that source on the surrounding air quality. Given the serious uncertainties associated with modeling fugitive emissions, and the potentially serious constraints imposed on economic growth by overconservative predictions, the Act should specify that fugitive emissions should *not* count in ambient estimates *if* BACT (or NSPS) is applied at the source and the fugitive emissions are isolated from population centers. Inasmuch as similar uncertainties affect the identification and modeling of natural sources of emissions, including wind-blown dust from dirt roads and cultivated lands, such emissions should be discounted in modeling analyses and compliance determinations, in accordance with Congressional intent.

D. Nonattainment

Under the nonattainment provisions of the Clean Air Act, where a state does not have an approved SIP in effect for a nonattainment area, EPA can impose a complete ban on construction in that area. The provision for a construction moratorium in such cases should be eliminated, since it can result in severe economic dislocation and even prevent improvements in air quality where it creates greater reliance on existing sources.

E. State Implementation Plans

In order that states have the capability to respond to EPA rulemakings, the Act should provide states with adequate funding to assist in the development and implementation of SIP requirements. In addition, section 406 of the Act should be revised to allow the states to receive an extension of the nine-month SIP development deadline where the number of sources to be modeled, or emission limitations to be set, precludes completion of SIP development within the nine-month period.

F. NSPS Waiver for Innovative Technology

Section 111(j)(1)(A) should be amended to remove the requirement for the projected achievement of "at least an equivalent reduction" in emissions as a condition to granting a NSPS innovative technology waiver. This fixation on only one of the several statutory requirements of NSPS is inconsistent with the balancing concept upon which NSPS is predicated. For example, an innovative technology that achieves less of a reduction in emissions but at substantial cost, energy, and environmental savings should be entitled to a waiver.

Summary of EEI Clean Air Act Issue Paper on Prevention of Significant Deterioration

Under the Clean Air Act, "significant deterioration" of air quality is defined in terms of allowable numerical increases (*i.e.*, increments) in the concentration of sulfur dioxide and particulate matter in areas where ambient levels of those two pollutants are better than those mandated by primary and secondary ambient air quality standards. The prevention of significant deterioration (PSD) provisions of the Act, as implemented by EPA, require that before a new major source can be built it must (1) undergo review to assure that it uses "best available control technology" (BACT); (2) conduct an air quality modeling analysis to demonstrate that the source will not violate any ambient standard or PSD increment; (3) conduct up to one full year of preconstruction monitoring for certain pollutants; (4) develop and submit to EPA detailed information on the facility's location, design, and planned operating schedule; (5) conduct and submit to EPA an analysis of any potential impairment to visibility, soils, and vegetation; and (6) "commence construction" within 18 months of obtaining the PSD permit. EPA's regulations also create complex requirements for processing PSD applications and for determining when a source has legally "commenced construction." Moreover, a PSD permit can be invalidated by EPA if (1) the source has a break in construction of 18 months or more, or (2) construction is not completed within a reasonable time. Finally, EPA's regulations require that, even after the PSD review process is completed and the permit issued to a source, the source may have to reduce its emissions further if it is estimated that an increment is being violated.

PSD requirements cause numerous problems for power plants, the most significant of which are:

1. The preconstruction review process (preparation of PSD permit application, review by EPA, submittal of more information to EPA, further review by EPA, public notice and comment, etc.) causes delays in the construction of new plants.
2. Uncertainty is created by the possibility that a new plant may become subject to even more stringent requirements to remedy future increment violations, even though the plant is using BACT and did not cause the violation.
3. EPA requires preconstruction monitoring that is needlessly expensive and time consuming.

These problems increase the expense of planning and building new power plants, and consequently tend to discourage the construction of new plants that are required to meet very stringent emission limitations.

CONGRESS SHOULD REVISE THE PSD PROGRAM SO THAT IT PROVIDES FOR PRECONSTRUCTION REVIEW TO ASSURE COMPLIANCE WITH NSPS, WITH AMBIENT AIR QUALITY STANDARDS, AND WITH ANNUAL CLASS I INCREMENTS.

Health Effects of Air Pollution

AMERICAN THORACIC SOCIETY
Medical Section of
AMERICAN LUNG ASSOCIATION
1978

FOREWORD

This review was commissioned by the Scientific Assembly on Environmental and Occupational Health, American Thoracic Society (ATS) as a revision and updating of an earlier (1973) ATS statement on this topic. The present review was written by members of the Ad Hoc Committee on the Health Effects of Air Pollution, not as an evaluation or critical review of existing primary air quality standards, but to provide an overview of the scientific evidence upon which protective standards should be based. The Committee has attempted to describe what is known about the contribution of air pollution to various respiratory disease entities, and to place this knowledge in perspective relative to other disease factors. In this process, the Committee often made judgments about the adequacy of the evidence for an association between air pollution and health. Although these judgments will inevitably be revised as new evidence is acquired, the Committee believes that the current body of evidence is sufficiently strong to warrant continuing vigilance and concern over the health effects of air pollution. We believe that a careful reading of this report will justify this concern.

Committee Members and Authors of this Review

CARL M. SHY, M.D., *Chairman*
JOHN R. GOLDSMITH, M.D.
JACK D. HACKNEY, M.D.
MICHAEL D. LEBOWITZ, Ph.D.
DANIEL B. MENZEL, Ph.D.

Health Effects of Air Pollution

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Health Effects of Air Pollution

Summary

Evidence for an association of air pollution with adverse effects on human health is drawn from 3 sources: animal experiments, experimental human exposures, and epidemiologic studies of exposed human populations. Each source of evidence has particular strengths and weaknesses.

Animal experiments provide information on a broad range of toxicologic effects and give insights into biologic mechanisms of response, but results cannot be directly extrapolated to human exposures. Through experimental human studies, human responses to individual pollutants can be precisely quantified, but even these findings may not be applicable to the population of "sensitive" persons or to the general population exposed to a complex and changing pollutant mix. Epidemiologic investigators can study effects of real-life exposures in various population subgroups; however, it is difficult to attribute the observed adverse health effects to specific concentrations of any 1 pollutant. Quantitative dose-response relationships are emerging from all 3 disciplines, and in some cases there is increasing convergence of evidence that provides a strong basis for regulation and public health protection. In any case, regulatory bodies must depend on the judgment of clinicians and other health scientists for an interpretation of the various and sometimes contradictory lines of evidence on the health effects of air pollution.

Adverse health effects have been associated with 3 major types of air pollution related to 3 major source categories: (*1*) the sulfur oxide and particulate complex arising from the combustion of sulfur-containing fossil fuels, particularly in fossil-fueled power plants, (*2*) photochemical oxidants formed in the atmosphere from a complex chemical reaction between precursor hydrocarbon compounds and nitrogen oxides, and carbon monoxide, both of which are largely related to motor vehicle emissions, and (*3*) a miscellaneous class of air pollutants such as arsenic, asbestos, beryllium, cadmium, hydrogen sulfide, lead, and mercury, which are mostly emitted by localized point sources, such as smelters, refineries, and manufacturing plants.

Nine general categories of adverse health effects have been related to human exposure to different air pollutants. These categories are listed in table 1.

Air pollution-associated mortality. Historically, the clearest evidence for an association between sulfur oxide/particulate air pollution and death was manifested by a number of acute air pollution episodes during which unfavorable meteorologic conditions resulted in several days of air stagnation and greatly increased concentrations of atmospheric pollutants. A striking increase in daily mortality occurred during these episodes, primarily among persons already afflicted with cardiac and respiratory disease, although even some healthy persons were affected. Fortunately, episodes of the duration and intensity reported before the early 1960s no longer seem to occur, at least in the cities of the United States and Western Europe. Given the many sources of atmospheric emissions in most urban areas and the generalized effect of air stagnations on all emission sources, no single air pollutant could be established as the causal factor for the observed excess of mortality.

Photochemical oxidants (ozone and nitrogen dioxide) are extremely toxic and even at relatively low ambient concentrations are respiratory-tract irritants. These properties have led some persons to express concern that photochemical oxidants might produce an air pollution episode with marked excess of mortality. None has been recorded thus far, possibly because of the dependence of this type of pollution on diurnal peaks of solar energy and the absence of sustained high concentrations of these pollutants.

The association of daily variations in sulfur oxide/particulate air pollution of lesser magnitude has also been studied with respect to fluctuations in daily mortality in metropolitan areas. Analyses of several sets of data tend to agree in finding greater mortality (from all causes combined) on days of greater pollution, without a clear-cut threshold for this response. However, the association between air pollution and daily mortality is not described by a simple linear relationship, and other determinants of day-to-day changes in mortality make it difficult to specify a pollutant concentration at which excess deaths begin to occur. Recent studies find little evidence for a relationship between air pollution and day-to-day mortality.

Studies of oxidant air pollution and daily mortality have not demonstrated a relationship between deaths and direct measurements of peak or daily oxidant concentrations among residents of Los Angeles County, where some of the highest ambient oxidant concentrations are reported. In laboratory animals, mortality from exposure to ozone is sharply dependent on concentration. Genetic factors and previous dietary intake, especially of vitamin E, also alter the sensitivity of different strains.

Investigators in various countries have reported associations between residence in areas of heavy air pollution and mortality from all causes combined, and from bronchitis and other respiratory causes. Most of these studies have shown this relationship with the sulfur oxide/particulate complex.

Chronic respiratory disease morbidity. Studies of chronic respiratory disease and air pollution conducted throughout the world have indicated that a relationship may exist between the prevalence of chronic respiratory symptoms and the sulfur oxide/particulate complex. Experimentally, ozone and nitrogen dioxide can induce emphysema-like changes in ex-

TABLE 1

ADVERSE HEALTH EFFECTS OF AIR POLLUTION*

Categories of Effects	*Location in Tables*
Air pollution-associated mortality	2-4
Chronic respiratory disease morbidity	5
Exacerbation of asthma	6
Acute respiratory disease morbidity	7-8
Effects on ventilatory function	9
Cancer of the lung	
Heart disease	
Sensory, neurological, and behavioral effects	
Effects from persistent metals and other pollutant residues	
Categories of Health-Related Air Pollutants	
The sulfur oxide/particulate complex	12
Photochemical oxidants	13
Nitrogen dioxide	14
Carbon monoxide	15
Other air pollutants	

*References are cited in text and tables

posed animals. Although these pollutants are not part of the sulfur oxide/particulate complex, their presence in many urban areas may be one of the factors accounting for these observed relationships. Few of the studies of chronic bronchitis and air pollution have been able to obtain measurements of air pollution in close proximity to the place of residence. Chronic respiratory disease appears to develop in response to cumulative and interacting factors, whether these be pack-years of cigarettes, recurrent infections beginning in childhood, or long-term exposure to occupational dusts and air pollution. The weight of evidence suggests that, although cigarette smoking exerts a much stronger effect, air pollution can be additive, and possibly more than additive, with cigarette smoking as a risk factor in the development of chronic respiratory disease.

Studies of the daily symptom status of patients with chronic obstructive lung disease show relationships between disease status and air pollution concentrations at relatively high concentrations of sulfur dioxide and particulates. Low temperatures can exert a greater effect than air pollution, and the similar temporal pattern of air pollution and cold temperatures in the past may have accounted for some of the relationships observed between air pollution and disease aggravation. British studies suggest that improvements in air quality during the past 10 to 15 years in England have largely abated the relationships between air pollution and disease aggravation.

Exacerbation of asthma. Asthmatic patients represent another segment of the population that appears to be susceptible to short-term peak concentration of air pollutants. Increased rates of asthma attacks were noted during episodes of sulfur oxide/particulate and photochemical oxidant air pollution. Several studies based on daily diaries kept by panels of asthmatic patients have shown a gradient of response between asthma attacks and days of higher concentrations of air pollution. Often, daily temperature variations were more strongly correlated with attack rates, but even when temperature-adjusted rates were computed, air pollution still exerted a significant effect. A recent experimental study in which asthmatic patients were exposed to relatively low concentrations of nitrogen dioxide before challenge with a chemical bronchoconstricting agent suggests the possibility that air pollution may enhance the asthmatic patient's reactivity to other stimuli.

The asthmatic person appears to represent an extreme on the scale of respiratory sensitivity to external stimuli, and the sum of the studies analyzed indicates that increased air pollution concentrations are 1 of many factors that can precipitate attacks in some fraction of asthmatic patients. Experimental evidence suggests a continuum in the dose-response relationship, with increasing numbers of asthmatic patients responding at higher concentrations.

Acute respiratory disease morbidity. Air pollution and impaired resistance to respiratory infection have been shown in laboratory animals at ambient or near ambient concentrations of ozone and nitrogen dioxide. In a number of studies of human adults, investigators have also observed a greater incidence of acute respiratory illness in communities with increased sulfur oxide/particulate concentrations. The sum of these studies supports a probable association between increased acute lower respiratory tract disease (acute bronchitis, pneumonia, other acute chest illnesses) in adults, and air pollution with the sulfur oxide/particulate complex and possibly with nitrogen oxides. The pollutant concentrations at which increased risk of acute illness occurs have not been established.

Rates of acute respiratory illness in children, particularly of illnesses of the lower respiratory tract, have been repeatedly associated with residence in more polluted communities affected by the sulfur oxide/particulate complex. These excess rates of illness can not be accounted for by social class, family size, or area differences in residential mobility. In several reports, the frequency and severity of acute lower respiratory disease have been shown to increase with the geographic gradient in air pollution and to diminish when air quality is improved in the more polluted areas.

Longitudinal studies of children conducted in England show an association between the prevalence of cough in young adults and exposure to air pollution in childhood. Cigarette smoking in adulthood and a history of childhood illness exerted a stronger influence on the prevalence of cough in young adulthood; nevertheless, the contribution of air pollution was detectable.

Effects on ventilatory function. Geographic differences in various air pollution indices have frequently been related to differences in ventilatory function, particularly in school children. A number of such observations have been reported in studies from England, Japan, the United States, Canada, and the Netherlands. Children residing in more polluted communities affected by the sulfur oxide/particulate complex tend to show diminished ventilatory function when compared with their counterparts—adjusted for age, sex, race, height, and social class—living in less polluted areas. Similar differences have not been consistently associated with photochemical oxidant concentrations in California, although an association of ambient oxidant concentrations and ventilatory function has been noted in England and Japan when air-pollution concentrations decreased in the affected regions. Filtered air chamber studies in California also suggest improved ventilatory function status in adults with chronic obstructive airway disease when these patients breathed filtered air from which pollutants had been removed.

Experimental human exposures have been particularly useful in determining the precise concentrations at which a single air pollutant, or combinations of several pollutants, can affect the airways of healthy adults. In some cases, adults with asthma or other forms of obstructive airway disease have been studied in this manner. A wide variability in human airway response to sulfur dioxide has been demonstrated in various experimental studies, with some evidence that sulfur dioxide can enhance the bronchoconstrictive effect of ozone on lung function.

Experimental exposure of human subjects to ozone alone reveals effects on ventilatory function at concentrations that are reached in ambient air, especially in areas characterized by oxidant pollution. These effects are reversible and, in themselves, do not necessarily constitute risk of disease, although the associated symptoms can impair performance of normal activities during and immediately after exposure. Exercise during exposure increases the pollutant effect on ventilatory function. Recent studies have reported a pollutant-induced enhancement of the effect of pharmacologic bronchoconstricting agents at relatively low concentrations of nitrogen dioxide, ozone, and sulfur dioxide. The significance of these findings with respect to combined exposure of hypersensitive persons to pollutants and naturally occurring bronchoconstricting agents remains to be evaluated.

Cancer of the lung. Several carcinogens have been detected in air. Of particular concern are recent reports of nitrosamines and polycyclic hydrocarbons. Based on the evidence gathered thus far, the suspicion that air pollution leads to lung cancer remains neither proved nor disproved. The overwhelming influence of cigarette smoking, the contribution of occupational exposures, the scarcity of good measurements of potential atmospheric carcinogens, and the long lag between first exposure and manifestation of cancer all contribute to the difficulty of obtaining evidence for a postulated relationship between air pollution and lung cancer.

Cardiovascular disease. Epidemiologic studies and experimental human exposures concur in demonstrating an adverse effect of ambient concentrations of carbon monoxide on persons with some forms of pre-existing coronary heart disease and peripheral atherosclerosis. Higher rates of case fatality among patients admitted to hospitals for myocardial infarction have been observed during periods of relatively increased carbon monoxide pollution. In experimental studies of patients with angina pectoris, carbon monoxide significantly decreased the amount of exertion that could be undertaken before onset of chest pain. Similar effects with respect to leg pain have been reported in men with peripheral artery disease. A further possible contribution to coronary heart disease is suggested by studies of animals in which carbon monoxide enhanced the effect of increased serum cholesterol on the development of atherosclerosis in rabbits that were fed cholesterol.

Sensory, neurologic, and behavioral effects. The odor of some airborne substances and the irritation to the eyes, nose, and throat caused by other pollutants are the most common and annoying aspects of air pollution for many persons. Perception of these effects is very real, but it is difficult to quantify their perception in populations. Odor annoyance survey methods have been developed and can be used for monitoring odorous pollutants. Ozone, the major component of photochemical smog, is directly irritating to the pharynx and trachea, causing a burning sensation in the upper part of the chest, particularly during vigorous exercise. These effects have been reported in Los Angeles and parts of Japan on "smoggy" days. The long-term health implications of this category of effects are largely unknown.

Carbon monoxide can alter human neurobehavorial performance as well as cardiac function. Decrements in vigilance tasks have been observed at relatively low carboxyhemoglobin saturations.

Inhalation of significant amounts of airborne lead can also give rise to neurologic changes, although concentrations of airborne lead commonly encountered in communities have not been shown to produce these changes.

Effects from persistent metals and other pollutant residues. In certain areas, exposure to lead has been shown to increase body stores, produce related biochemical impairments, and cause slower nerve conduction. Such effects may impair neural development in children, but data on this type of effect are scant, and no agreement exists. Local sources of other persisting materials, such as smelters, refineries, and chemical plants, can also affect storage of persistent materials and produce biochemical effects.

Health effects of the sulfur oxide/particulate complex. The sulfur oxide/particulate complex is not a chemically or physically specific mixture, but one that varies from place to place in particle-size distribution, oxidation state, and chemical species. Greatly increased ambient concentrations have been consistently associated with greater mortality during episodes of air pollution and with the aggravation of symptoms in subjects with heart and lung disease. In more polluted cities, there is considerable evidence for a greater prevalence of chronic respiratory disease in adults and an increased incidence of acute respiratory disease and depressed lung function in children.

Animal experiments and particle-size characteristics suggest that sulfates and other transformation products of sulfur dioxide may be more responsible for the biologic reactivity of the sulfur oxide/particulate complex than are direct measurements of sulfur dioxide and total particulate matter. Interactions between sulfates, metallic cations, and ammonia have been found; these interactions make particularly important the chemical identification of sulfur oxide/particulate fractions. For practical reasons, ambient concentrations of sulfur dioxide and total suspended particulates, or smoke, are commonly reported and used to assess the quality of air for this class of pollutants. Concentrations of sulfur dioxide and particulates each in excess of 100 μg per m^3 are generally associated with the augmentation of respiratory symptoms, lung function changes, and increased risk of acute and chronic respiratory disease.

Health effects of photochemical oxidants. The primary target tissues of inhaled ozone, which constitutes the largest component of the photochemical oxidant complex, are the respiratory tract and pulmonary parenchyma. Experimental exposure of animals to ozone in the range of 200 to 1,000 μg per m^3 (0.10 to 0.50 parts per million [ppm]) induces structural changes in lung tissue and increased susceptibility to respiratory pathogens. In rats and mice, mortality occurs with continuous exposure to ozone of 2,000 μg per m^3 (1 ppm) or more. Morphologic changes induced at lower concentrations are not fully reversible. Experimental human exposure to ozone for 2 hours causes decrements in various measures of pulmonary function in healthy exercising men at concentrations of 740 μg per m^3 (0.37 ppm) or more, and there is good reason to believe that these changes take place at lower concentrations in more reactive subjects. Epidemiologic studies in the Los Angeles basin and in Japan have reported associations between ambient ozone or oxidant concentrations in the range of 200 to 600 μg per m^3 (0.10 to 0.30 ppm) in the presence of other pollutants and eye irritation, cough, and chest discomfort, especially in exercising groups.

Health effects of nitrogen dioxide. Experimental short-term exposure of healthy adults or of persons with chronic bronchitis appears to have no detectable effect on ventilatory function until concentrations of 3,000 to 3,760 μg per m^3 (1.6 to 2.0 ppm) are reached. Recently, one investigator reported an enhancement of the bronchoconstrictor effect of pharmacologic agents in asthmatic patients pre-exposed to 210 μg of nitrogen dioxide per m^3 (0.11 ppm) but the relevance of these findings to naturally occurring combinations of bronchoconstrictors and ambient nitrogen dioxide is unknown.

Like ozone, nitrogen dioxide induces various structural changes in the lungs of laboratory animals. Increased susceptibility to respiratory pathogens has also been produced by continuous or intermittent exposure to nitrogen dioxide for 3 to 6 months at concentrations of 940 to 1,880 μg per m^3 (0.5 to 1.0 ppm).

Epidemiologic studies of population groups exposed to nitrogen dioxide in the presence of other pollutants have shown associations between increased incidence of acute respiratory disease and ambient concentrations of nitrogen dioxide in the range of 150 to 280 μg per m^3 (0.08 to 0.15 ppm). Coexisting sulfur oxide/particulate pollutants complicate the application of these findings to the general environment. At high concentrations, observed with occupational exposures, maximal effects of nitrogen dioxide may occur from 1 to 3 days after exposure. Some epidemiologic data indicate that acute reactions to complex urban pollutants may occur 1 or 2 days after peak exposures.

Health effects of carbon monoxide. The effects of carbon monoxide stem primarily from its affinity with oxygen-carrying hemoproteins, which causes a leftward shift and steeper slope of the oxyhemoglobin dissociation curve and decreases the amount of such hemoprotein available for oxygen transport. Persons with circulatory diseases who are unable to compensate for oxygen deprivation by increased blood flow to affected organs are particularly likely to experience adverse effects from exposure to relatively low concentrations of carbon monoxide. Several experimental studies have shown that persons with coronary heart disease, as manifested by angina pectoris, experience chest pain significantly earlier during exertion when carboxyhemoglobin concentrations increase from baseline (usually 0.5 per cent) to 2.5-3.0 per cent, an effect that can be induced by 1-hour exposures to carbon monoxide at concentrations of 80 to 100 mg per m^3 or by 8-hour exposures to concentrations of 17 to 21 mg per m^3. Suspected long-term effects of carbon monoxide on arteriosclerosis and vascular disease have been suggested by experimental exposure of animals and by epidemiologic studies of smokers.

Carbon monoxide has also been shown to have an effect on the function of the central nervous system. In humans, experimental studies have reported impairment of vigilance tasks in the range of carboxyhemoglobin concentrations from 3.0 to 6.5 per cent. Epidemiologic studies have suggested an effect of ambient carbon monoxide exposure on daily mortality variations and case-fatality rates for persons hospitalized with acute myocardial infarction.

Health effects of other pollutants. Lead in ambient air has been associated with increased lead concentrations in the blood of adults and children. A contribution of motor vehicle emissions to lead in dirt and street dust may account in part for a general finding that urban children, especially those living close to dense traffic, have higher blood lead concentrations than do rural children.

Asbestos, mercury, beryllium, and vinyl chloride are designated as hazardous air pollutants because they may be associated with disease risk at relatively low concentrations. These materials may accumulate in the body over time and induce adverse effects of insidious onset.

Conclusion. Animal experiments and occupational and experimental human findings, together with the experience of human populations exposed to community pollution, have provided qualitative and quantitative understanding of health effects of community air pollution. Air quality standards have been developed and supported in order to prevent such effects. The adequacy of scientific data and their interpretations have been reviewed by the National Academy of Sciences and by other organizations.

In general, the standards have been set at concentrations that were judged to protect sensitive groups from significant health impairment. Although it would be desirable to establish a standard at some concentration below a demonstrable threshold for adverse effects, in practice it is not feasible to determine these thresholds among various segments of the population. In some cases, as in the effect of exposure to carbon monoxide on the oxygen-carrying capacity of the blood, there is no practical threshold. Standards also do not guarantee or assure that unusually sensitive persons will be protected against all adverse health effects, especially if the effects are enhanced in the presence of other pollutants, other health conditions exist simultaneously, or extraordinary meteorologic conditions occur. At exposures to pollutant concentrations above the standards, there is increasing probability of damage to human health.

1. INTRODUCTION: PURPOSE AND SCOPE

This review is offered for the purpose of presenting what is known about the effects of air pollution on human health, with special emphasis on the respiratory system, and is directed to the informed layperson, the physician, and the staff and volunteers of the American Lung Association and its many constituents. The report is not intended as a critical review of the literature or as an evaluation of primary air-quality standards.

Surveys of the health effects of air pollution have been made for selected pollutants, in the U.S. air quality criteria documents for particulate matter (U.S. Department of Health, Education, and Welfare* [DHEW], 1969a), sulfur oxides (U.S. DHEW, 1969b), carbon monoxide (U.S. DHEW, 1970a), photochemical oxidants* (U.S. DHEW, 1970b), hydrocarbons (U.S. DHEW, 1970c) and nitrogen oxides (U.S. Environmental Protection Agency [EPA], 1971). These criteria documents are currently being revised by the U.S. Environmental Protection Agency. The Committee on Medical and Biologic Effects of Environmental Pollutants, National Academy of Sciences-National Research Council has overseen the preparation of a series of comprehensive reports by subcommittees chosen for their scientific expertise relating to the medical, biologic, and environmental effects of selected air pollutants. Since 1971, the following reports have been published by the National Academy of Sciences under that committee:

Title	*Year*	*Length (pp.)*	*Reference No*
Asbestos	1971	40	281
Fluorides	1971	291	282
Lead	1972	330	283
Particulate Polycyclic Organic Matter	1972	361	284
Manganese	1973	191	285
Chromium	1974	155	286
Vanadium	1974	117	287
Nickel	1975	277	288
Chlorine and Hydrogen Chloride	1976	282	289
Selenium	1976	203	290
Vapor-Phase Organic Pollutants	1976	411	291
Arsenic	1977	332	292
Carbon Monoxide	1977	239	293
Copper	1977	115	294
Nitrogen Oxides	1977	333	295
Ozone and Other Photochemical Oxidants	1977	719	296
Platinum Group Metals	1977	239	297

Other less comprehensive but still lengthy literature reviews on the health effects of several air pollutants appear in the following publications:

> World Health Organization, Air Quality Criteria and Guides for Urban Air Pollutants (395).
>
> National Academy of Sciences, Proceedings of the Conference on Health Effects of Air Pollution (277).

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*References are listed alphabetically in Bibliography.

National Academy of Sciences, Air Quality and Stationary Source Emission Control (279).

American Physiological Society, Reactions to Environmental Agents (Am. Physiol. Soc., 1977).

Journal of the Air Pollution Control Association, Toxicologic and Epidemiologic Bases for Air Quality Criteria (205). Includes separate reviews of particulates/sulfur oxides (9,345) oxidants/nitrogen oxides/hydrocarbons (272,397), lead (147,210), and carbon monoxide (35,148).

Clinical Implications of Air Pollution Research (Finkel, A.J., and W.C. Duel, eds., 1976).

Stern, A.C., Air Pollution (3rd ed.) Vol. II (Stern 1977)
  Chapter V : Biological effects of air pollution (Coffin and Stokinger, 1977)
  Chapter VI : Organic particulate pollutants-chemical analysis and bioassays for carcinogenicity (Hoffman and Wynder, 1977)
  Chapter VII: Effects of air pollution on human health (Goldsmith and Friberg, 1977)

Air Pollution and the Lung. Proceedings of the Twentieth Annual "OHOLO" Biological Conference (Aharonson et al, eds., 1976)

Royal College of Physicians of London, Air Pollution and Health (Roy. Coll. Phy., 1970)

Holland, W.W. (ed.), Air Pollution and Respiratory Disease (1972 [194])

Lee, D. H. K et al (eo.), Reactions to Environmental Agents (1977 [234])

It is beyond the scope of this statement to duplicate or even paraphrase these comprehensive reviews, and readers who require detailed information concerning the health effects of specific pollutants should consult these sources. Rather, the purpose of this statement is to summarize what is known of the relationship between human exposure to ambient air pollution and diseases of the respiratory and cardiovascular systems. The intent is to review the effects of air pollution on human populations (Section 2), to indicate some of the health effects and mechanisms of action of specific air pollutants on affected organ systems (Section 3), and to provide examples of attempts to assess the magnitude of the public health effects of air pollution (Section 4).

Because this monograph is an overview, it was necessary to be selective in citing references that contribute to our knowledge of the health effects of air pollution. The absence of many published reports from the list of citations is not meant to suggest that these data were unimportant or even redundant. As in all selective reviews, it is the reviewer's judgment, disciplinary skill, or limited knowledge that determines which citations are used to describe a relationship between exposure and disease. Restricted space requires that many aspects of these exposure-disease relationships receive limited discussion. Several environmental health issues that are closely related to a comprehensive assessment of the health effects of air pollution also were not treated in this monograph, e.g., indoor air pollution, household chemicals, sidestream tobacco smoke, and a host of occupational health hazards. All of these are lengthy topics in themselves and are simply beyond the scope of the present review.

Lines of evidence concerning air pollution health effects. Three lines of evidence are applicable to a consideration of the human health effects of air pollutants. These include data derived from animal experiments, from the limited range of ethical and practical experimental human exposure, and from epidemiologic studies of exposed human populations both in the community and workplace.

The study and interpretation of health effects tend to become more complex from the experimental through the epidemiologic approach; however, the relevance to human health protection increases in the same direction. With animal exposures, one can determine a dose-response curve for a single pollutant, from the earliest objective evidence of physiologic or biochemical effects to a fatal outcome. However, the likelihood of symptoms or impairment in humans cannot so readily be documented on the basis of animal experimentation. A serious weakness of animal experimentation is the uncertainty of its quantitative relationship to human health. We know enough, for example, about species differences in airway resistance to make us cautious in applying quantitative data obtained from exposed guinea pigs (a hyperreactive species) to humans. Nevertheless, experiments in animals are both necessary and appropriate to assure adequate protection of human health. Causal relationships between pollutant doses and development of pathology can be more definitively established in experimental studies than in observations on the incidence and course of disease in humans. Similarly, mechanisms of action can be more easily assessed in animals than in humans. With increasing knowledge, the convergence of evidence from experimental air pollutant-caused pathology and from studies of human pulmonary diseases is becoming more apparent, thus supporting the causal relationships suggested from clinical and epidemiologic findings.

Experimental studies of exposed human volunteers carried out under carefully controlled conditions can establish the occurrence of acute health responses in normal and hyperreactive persons. Such studies can be designed to detect pollutant concentrations that induce minimally measurable effects of specific pollutants in the absence of interfering pollutants or certain other factors. The facilities needed for such studies often include costly exposure chambers and equipment for air cleaning and precise monitoring and control of pollutant doses (National Research Council, 1977e). Because of ethical and practical considerations, human experiments are limited to short-term reversible effects and to adults without advanced stages of disease. Similarly, because of logistic problems, investigators can only evaluate the effects of isolated exposures to 1 pollutant or combinations of 2 or 3 pollutants. The complex, dynamic mixture of pollutants in the ambient air cannot be fully duplicated in the exposure chamber. These factors place limits on the applicability of findings from experimental human exposure to the general population that includes a broad range of age, susceptibility, and exposure to complex mixtures of pollutants and other disease risks.

Epidemiologic studies, although more realistic with respect to actual exposures of the general population, are also most difficult to interpret in light of the combined impact of age, occupational exposures, cigarette smoking, housing, medical care, urbanization, and other factors. Most of the documented health effects of community air pollution are also produced by smoking. Questions as to whether pollution effects can be isolated from smoking effects, and whether there is interaction among these exposures are important in developing guidelines for the protection of public health. Occupational exposure data are often available for pollutants of concern in the community, but quantitative relationships observed on exposure of employed groups tend to underestimate the impact on community health, because the employed population is usually pre-selected for reasonably good health, whereas the community population includes such sensitive groups as infants, the elderly, persons with serious impairment of cardiopulmonary function or with disease states such as asthma, each of which is likely to make these persons more reactive.

With accumulating experience, we now realize that any one of these lines of evidence can initiate a concern for public health protection, but that the results of research tend to converge not only qualitatively but quantitatively on dose-response relationships, which form a basis for regulation and public health protection. Gaps that previously existed between epidemiologic evidence of low-dose exposures and effects of pollutants such as lead and carbon monoxide (CO) have virtually closed, and general dose-response relationships are widely accepted. In the case of photochemical oxidant pollution, epidemiologic studies of exercising groups have reported the occurrence of respiratory symptoms and impairment of performance at ozone concentrations that are in agreement with concentrations at which objective changes in pulmonary function have been observed in experimentally exposed human subjects. (Section 3). For the sulfur oxide-particulate complex, epidemiologic evidence suggested that adverse health effects are associated with ambient sulfur dioxide (SO_2) concentrations of less than 1 ppm, whereas experimental human studies did not find physiologically significant effects at concentrations of less than 2 to 5 ppm, when average responses of the group were considered. The experimental human exposure data, however, usually included 1 or more persons who appeared unusually reactive. Such persons in the general population may account for the effects observed in epidemiologic studies. Provocative tests with histamine or bronchoconstricting agents may be useful for detecting subtle hyperreactive responses (Orehek, 1976) in such persons.

The most effective use of scientific resources for the protection of public health from the effects of air pollution requires that information from these 3 disciplinary lines of evidence be carefully weighed and brought to bear on judgments and recommendations made by clinicians and other health scientists. The clinician is often the first person in the community to know that air pollution may be producing untoward effects on the health of his or her patients, but seldom has the opportunity to accumulate enough evidence to quantify these effects adequately. These clinical observations need to be passed on to the experimental researcher and the epidemiologist. When specific air pollutants are identified, the toxicologist can often determine whether clinical and epidemiologic observations can be confirmed experimentally or are at least toxicologically plausible. The epidemiologist can design observational studies of possible long-term and delayed effects such as cancer, emphysema, and heart disease among groups with gradients in exposure to air pollution. Air-quality standards and other control measures for the protection of public health are most credible and beneficial to society when all 3 groups—clinicians, experimental health scientists, and epidemiologists—share in the elaboration of knowledge, in analysis and interpretation of the body of scientific evidence, and in the making of judgments concerning concentrations of air quality that are desirable for public health.

Overview. Section 2 constitutes the largest part of this review and presents the evidence that human exposure to air pollution has been associated with excess mortality, acute and chronic respiratory disease, disturbances in ventilatory function, asthma, heart disease, sensory and central nervous system effects, and tissue residues. Most of this evidence is based on epidemiologic studies, although important contributions have also come from experimental studies of human volunteers.

Section 3 provides a more limited review of the health effects of specific air pollutants and discusses some of the experimental data on which this knowledge is based. Ambient or near-ambient concentrations of pollutants associated with these effects are presented within the tables of Section 3, but it should be emphasized that the evidence for an association between ambient concentrations and human disease states is still evolving.

Our ability to know at what concentrations human populations begin to have increased risk of adverse effects is limited by our ability to measure the earliest responses in the most sensitive groups, to obtain air pollution measurements that adequately reflect human exposure, and to extrapolate dose-response relationships from animals to humans.

Section 4 discusses issues involved in evaluating the human health risks of exposure to air pollution, and provides examples of some efforts to assess over-all health risks. Members of the health community are asked by legislators, government officials, and laypeople to make judgments concerning the value, in terms of disease prevention, of controlling air pollution to a certain degree. Are the strict automobile emission standards necessary? Will expanded coal combustion pose a serious health threat? To answer these important questions, we are required to assess the benefits or consequences of incremental changes in air quality. The difficulty of making these evaluations is considered in this section.

Types of air pollution. Three major types of air pollution can be recognized: the sulfur oxide and particulate complex, photochemical oxidants, and a miscellaneous category of pollutants that arise from industrial point sources such as smelters, mines, and factories. The first 2 pollutant types are ubiquitous and occur in increased concentrations particularly in large metropolitan areas. The third type will vary with the industrial activity of individual localities.

The sulfur oxide and particulate complex is produced by combustion of sulfur-containing fossil fuels, especially coal and crude oil in fossil-fueled power plants. The sulfur oxide component includes various amounts of SO_2, sulfuric acid, and sulfate aerosols. The particulate component consists of soot, fly ash, metallic oxides such as iron, zinc, and silicates, aerosols of sulfates, and nitrates and other compounds. The sulfur oxide-particulate complex contains compounds both in the gas and particle phases, with atmospheric transformations from gas to particle phases taking place in a dynamic mixture. There are more studies of the human health effects of this type of pollution than of other categories, mainly because sulfur oxides and particulates were recognized early as pervasive air pollutants, could be monitored with commercially available instruments, and were frequently used as indices of biologically reactive contaminants in the air. Much of the early evidence on the health effects of the sulfur oxide/particulate complex was obtained when coal was commonly burned as the fuel for heat in homes. Conversion to oil and natural gas has altered the physical and chemical characteristics of the ambient sulfur oxide/particulate complex, and these qualitative changes are not wholly reflected in the measurements provided by current air quality monitoring. In particular, changes in particle size distribution and in the chemical nature of sulfate and nitrate aerosols have not been routinely characterized.

Photochemical oxidants are formed in the atmosphere from a complex chemical reaction between solar radiation and nitrogen oxides and hydrocarbons. Most hydrocarbons are emitted from motor vehicles, although other sources such as petroleum refineries, manufacturers and users of solvents contribute significant amounts in some localities. Fossil-fueled electric power plants also contribute sizable amounts of nitrogen oxides. Photochemical oxidants characteristically have 4 manifestations: formation of ozone, acute eye and respiratory tract irritation, specific types of plant damage, and formation of a visible atmospheric aerosol, or smog. Ozone is often measured as an index of photochemical oxidants in ambient air and is the most abundant component of oxidant mix, although ozone alone does not adequately account for some of the manifestations cited above. Photochemical oxidants also contain both a gas phase and a particulate aerosol phase. Other components of the oxidant group include oxides of nitrogen, peroxyacyl nitrates, and suspended nitrates, each of which may have important, although less well identified health effects.

Two other pollutant compounds not included in the oxidant group are closely related to motor vehicle emissions: CO and airborne lead. These are briefly discussed in Section 3.

The third large class of air pollutants comprises the variable emissions from smelters, mills, refineries, factories, and all other point sources. Arsenic, cadmium, mercury, asbestos, hydrogen sulfide, and a host of other pollutants arise from these sources and may appear in the gas or particle phase.

2. Air Pollution and Diseases of the Respiratory and Cardiovascular Systems

Air Pollution and Mortality

Acute Air Pollution Episodes. Historically the clearest evidence for an association between sulfur oxide/particulate air pollution and death was manifested by a number of acute air-pollution episodes during which meteorologic conditions caused several days of air stagnation and greatly increased concentrations of atmospheric pollutants. The best known of these episodes are those which occurred in the Meuse Valley of Belgium in 1930 (Firket, 1931), in Donora, Pennsylvania in 1948 (Schrenk *et al.*, 1949) in London in 1952 (Logan, 1953; Ministry of Health, 1954) and again in 1962 (Scott, 1963), and in New York City in 1953 (Greenburg *et al.*, 1963). The number of deaths attributed to high concentrations of air pollution, as shown in table 2, was calculated from the difference between the number of deaths recorded during the episode and the number expected for that same time period. Expected deaths were variously computed, from mortality counts during the same time period in previous or subsequent years, during immediately previous and subsequent weeks, or from a moving average of daily death counts during the same season.

In the most dramatic of these episodes, the London fog of December 1952, excess deaths occurred on the first day of the episode, predominantly among persons already suffering from cardiac and respiratory disease, although all ages were affected to some extent (Ministry of Health, 1954; Scott, 1953; Logan, 1953). In London, the excess deaths were attributed mainly to bronchitis, pneumonia, and other respiratory and cardiac diseases; in New York City, to pneumonia, influenza, cardiac diseases, and to "all other diseases." Excess deaths were found particularly among persons 45 years of age and older. Excess deaths continued for several weeks, and a role for an epidemic of influenza has been proposed to account for the persistence of this excess.

TABLE 2
SELECTED AIR POLLUTION EPISODES

Date	*Place*	*Attributed Excess Mortality*
December 1930	Meuse Valley, Belgium	63
October 1948	Donora, Pennsylvania	20
December 1952	London, England	4,000
November 1953	New York City	200
December 1962	London, England	700

Nine years after the Donora episode, Ciocco and Thompson (1961) restudied the population of that community and found that persons reporting illness during the episode had higher subsequent mortality rates and a greater prevalence of disease than did those who were not ill. These findings suggest the possibility that acute episodes may diminish subsequent life expectancy or that those who respond to environmental stress are more susceptible to serious disease (National Academy of Sciences, 1975). At Donora, it was also learned that 6,000 of the 13,000 residents were adversely affected by the 1948 episode (Schrenk *et al.*, 1949). In general, concentrations of particulate matter and of SO_2 in excess of 1,000 μg per m^3 were required to produce these major disturbances in mortality (Bennett *et al.*, Unpublished data).

The importance of these air pollution episodes, other than their impact on the exposed populations, is that they drew the attention of the medical community to the public health consequences of uncontrolled air pollution and undoubtedly hastened the institution of control programs. Although episodes of lesser severity have been reported since 1962 (e.g., New York, 1963; McCarroll and Bradley, 1966), it is now very difficult to detect changes in mortality of the magnitude associated with the classical air pollution episodes. Episodes of the duration and intensity reported before the early 1960s have not recurred, at least in the cities of the United States and Western Europe. No single air pollutant was found to be responsible for increased mortality during these episodes, because stagnant conditions diminish the rate of dispersion from all emission sources.

Photochemical oxidants (ozone and NO_2) are highly toxic and even at relatively low ambient concentrations are a respiratory tract irritant. These properties have led some to express concern that photochemical oxidants could produce an air pollution episode with marked excess mortality. None has so far been recorded, possibly due to the dependence of this type of pollution on diurnal peaks of solar energy and to absence of sustained high concentrations of these pollutants.

Short-Term Variations in Mortality and Air Pollution. The observed relationship of sulfur oxide/particulate air pollution episodes to excess mortality led investigators to examine the possible association of air pollution of lesser magnitude with variations in daily mortality (Martin and Bradley, 1960; Martin, 1964; Boyd, 1960; Brasser *et al.*, 1967; Joosting, 1967; Buechley *et al.*, 1973; Schimmel and Greenburg, 1972; Schimmel and Murawski, 1975; Lebowitz, *et al.*, 1973a, 1973b). The aim in these studies was to determine whether some portion of the variation in daily mortality could be explained by day-to-day differences in air pollution concentrations, and whether there is some concentration above which excess mortality becomes extremely likely.

On the whole, these analyses tend to agree in finding greater mortality (from all causes combined) on days of greater pollution, without a clear-cut threshold for this response. However, the association between air pollution and daily mortality is complex and cannot be described by a simple linear relationship. Many intervening factors, such as temperature extremes, influenza epidemics, holiday weekends, and season of the year, have strong effects on the day-to-day number of deaths and may enhance or minimize the effect of air pollution. Some investigators failed to account for these intervening variables, whereas others measured them in different ways or variously analyzed their effects. Thus, there is no agreement among the different reports as to how many deaths may be attributed to air pollution of a certain degree or at what concentrations daily mortality is significantly increased above the expected number of deaths.

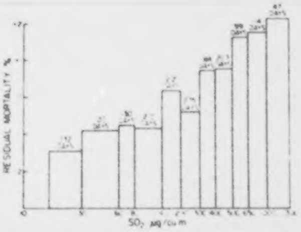

Fig. 1. Means of residual mortality by SO_2 concentration in New York-New Jersey metropolitan area, 1962-1966 (1,826 days). Source: Buechley *et al.*, 1973.

The analysis of Buechley *et al.* (1973), as shown in figure 1, is illustrative of this group of studies. The study was based on daily reported deaths from all causes in the entire New York metropolitan area for 1962 to 1966. Air-quality data were obtained from a single monitoring station in upper Manhattan. (In this respect, Blade and Ferrand [1969] showed reasonably good correlation of day-to-day concentrations of air pollution among the multi-station network of New York City monitoring stations, although Goldstein [1977] argued for inadequate representation of air quality by a single station.) The investigators first adjusted their mortality counts for the effects of several relevant factors, including seasonal cycles, extremes of temperature, daily and weekly temperature deviations from the mean, holidays, day of the week, and influenza epidemics. After serial elimination of these factors, SO_2 was found to be correlated with the residual daily mortality, which was 2 per cent more than expected on days when SO_2 concentrations exceeded 500 μg per m^3 (0.19 ppm) and 1.5 per cent less than expected when the concentration of SO_2 was less than 30 μg per m^3 (0.01 ppm). The graphic portrayal of this relationship in figure 1 shows a general stepwise increase in residual mortality with increasing concentrations of SO_2, but without an evident threshold for this effect. The authors state that measures of particulate pollution relate just as well as SO_2 to daily mortality counts, and that it was not possible to disentangle the isolated effect of either pollutant. Thus, a causal relationship between SO_2 alone and mortality cannot be inferred from this analysis.

Similar studies of mortality in New York City between 1960 and 1968 were carried out by McCarroll and Bradley (1966), Hodgson (1970), Glasser and Greenburg (1971), Schimmel and Greenburg (1972), and Lebowitz (1973a). These investigators agreed in finding an association between increased mortality and air pollution at higher concentrations. Schimmel and Murawski (1975, 1976) analyzed mortality data for New York City through 1972 and concluded that despite declining concentrations of SO_2, effects on deaths have remained nearly the same as in the period 1963 to 1968. They consider SO_2 to be an imperfect index of a family of pollutants that appear jointly with SO_2 but are probably the real contributors to excess mortality. An alternative explanation is that pollution has not been a significant contributor to daily variations in mortality, especially at lower concentrations (i.e., lower than those experienced during episodes). Lebowitz (1973a) attempted to deal with the issues of variable time lags between exposure and mortality and with other overlapping events by using a "stimulus-response" model in which he examined pairs of events near enough in time for one to be a cause of the other. A significant relationship between periods of heavy pollution and increases in deaths was found for New York in 1962 to 1965, Philadelphia in 1963 to 1964, Los Angeles in 1962 to 1965 (Lebowitz, 1973a), and Tokyo in 1966 to 1969 (Lebowitz *et al.*, 1973b), but the method did not enable the author to relate specific concentrations to increased mortality.

Studies of short-term variations in mortality and air pollution characterized by the sulfur oxide/particulate complex were conducted during the 1950s and 1960s in countries other than the United States and Great Britain, and have consistently shown a similar pattern of increased mortality on days or weeks with greater pollution, e.g., in Oslo, Norway, 1958 to 1965 (Lindeberg, 1968), in Osaka, Japan, 1962 to 1966 (Watanabe and Kaneko, 1971), in the Netherlands, 1959 to 1962 (Brasser *et al.*, 1967), and in Tokyo, 1966-1969 (Lebowitz, 1973b).

On the other hand, a series of studies of oxidant air pollution and daily mortality has not demonstrated a relationship between deaths and direct measurements of peak or daily oxidant concentrations among Los Angeles County residents 65 years of age and older (California Department of Public Health, 1955, 1956, and 1957), in the general population of Los Angeles during 3 different heat waves (Oechsli and Buechley, 1965), among elderly residents of Los Angeles nursing homes (California Department of Public Health, 1955, 1956, and 1957), or in the general population of Los Angeles County for the years 1956 through 1958 (Hechter and Goldsmith, 1961). Typically, peak oxidant concentrations occur during the summer months in Southern California, when mortality rates are at a seasonal low.

The same type of analysis did show an association between carbon monoxide concentrations and increased rates of case fatality for patients admitted to Los Angeles hospitals with myocardial infarction, (Cohen *et al.*, 1969) and with the total number of deaths in Los Angeles by day of occurrence (Hexter and Goldsmith, 1971). This association is supported by other studies, to be discussed subsequently, demonstrating an acute effect of CO on cardiovascular function and symptoms in patients with coronary heart disease and peripheral arteriosclerosis.

Effects of Chronic Exposure on Mortality Rates. In studies of air pollution episodes or short-term variations in degrees of air pollution, each population can serve as its own control. Other determinants of temporal variations in mortality can be identified and generally accounted for, and the effect of air pollution on residual mortality can be estimated. By contrast, in evaluating the mortality consequence of long-term residence in areas of heavy pollution, an exposed population cannot serve as its own control, and the mortality experience of different geographical units, within the same metropolitan area or in other cities or counties, but with lower degrees of air pollution, is usually considered a comparison or "control" group. Differences in mortality rates among geographic units cannot be attributed to differences in degrees of air pollution unless data on other determinants of geographic differences in mortality are taken into account. In many studies, information on these contributors to mortality is lacking or difficult to obtain. Thus, important factors such as smoking habits, socioeconomic status, length of residence in the geographic unit, occupation, pre-existing disease, ethnic background, and diagnostic accuracy in filling out death certificates may significantly influence the reported mortality rate in each area. Death certificates and other sources of information about decedents seldom provide adequate data on these variables. Further, there are frequent interrelationships between the degree of air pollution in a geographical area and the occupational and socioeconomic levels of these areas. A simple analysis of the relationships between air pollution and mortality may be confounded by these intervening factors. Despite these limitations on the collection and analysis of data, several studies conducted by different investigators in various countries, at different times and under different circumstances, have reported associations between residence in areas of heavy air pollution and mortality from all causes combined, and from bronchitis and other respiratory causes. Some of these studies are summarized in table 3.

The reports of Winkelstein and associates (1962, 1968, and 1969) are illustrative of the analytic approach and problems encountered in these studies. Using a 21-station monitoring network, the authors classified each of the 120 census tracts of Buffalo according to 4 values of particulate pollution. Census tracts were also subdivided into 5 socioeconomic strata on the basis of data from the 1960 census. Mortality rates for all causes in 1959 to 1961 were derived for each of the 20 air pollution/socioeconomic categories, as shown in table 4, for white men 50 to 69 years of age. Within each socioeconomic category other than stratum 5, an increasing mortality gradient was found across

TABLE 3

ASSOCIATION OF GEOGRAPHIC DIFFERENCES IN MORTALITY WITH LONG TERM RESIDENCE IN AREAS OF HEAVY AIR POLLUTION

Study	*Characteristics*	*Findings*
Pemberton and Goldberg (1954)	1950–1952 bronchitis mortality rates in men 45 years of age and older in county boroughs of England and Wales	Sulfur oxide concentrations (sulfation rates) were consistently correlated with bronchitis death rates in the 35 county boroughs analyzed
Buck and Brown (1964)	Bronchitis mortality in 214 areas of Britain, 1955–1959, evaluated with respect to SO_2, particulates, social index, and population density	Social index and SO_2 accounted for 36 per cent of the variation in bronchitis mortality within county and noncounty boroughs and in urban districts. Within London boroughs, social index was the most important factor
Stocks (1959)	Bronchitis mortality, 1950–1953, in urban and rural areas of Britain, with adjustments for population density and social index	Significant correlation of mortality from bronchitis and pneumonia among men, and from bronchitis among females, with smoke density
Gorham (1958, 1959)	1950–1954 deaths, 53 counties of England, Scotland, and Wales	Bronchitis mortality was strongly correlated with acidity of winter precipitation.
Gore and Shaddick (1958), and Hewitt (1956)	Mortality in London, 1954–1958, and in 1950–1952, respectively	Duration of residence in London was significantly correlated with bronchitis mortality, after adjusting for social class
Burn and Pemberton (1963)	1958/1959 deaths from all causes, bronchitis, and lung cancer in 3 polluted areas of Salford, England	The gradient of mortality from all causes and from bronchitis and lung cancer followed the pollution gradient.
Zeidberg *et al.* (1967)	1949–1960 deaths for each cause in Nashville, Tenn., categorized by census tract into 3 degrees of air pollution and 3 economic classes	Within the middle social class, total respiratory disease mortality, but not bronchitis and emphysema mortality, were significantly associated with sulfation rates and social index. White infant mortality rates were significantly related to sulfation rates.
Winkelstein *et al.* (1962, 1967, 1968)	120 census tracts in Buffalo stratified into 4 degrees of particulate pollution and cross-stratified into 5 economic classes	Within an economic class, death rates of white men 50–69 years of age, for all causes and for chronic respiratory disease corresponded to the gradient of particulate, but not SO_2, pollution.
Lave and Seskin (1970)	Multiple regression analysis of mortality as a function of air pollution, population density, socioeconomic status, age, and race, in 114 Standard Metropolitan Statistical Areas of the U. S., 1960	Air pollution (particulates and sulfates) was a significant variable in the regression models for total death rates and death rates for infants less than 1 year of age. Effect of age differences was not entered into the model.
Lepper *et al.* (1969)	1964/1965 mortality rates in Chicago census tracts stratified by socioeconomic class and SO_2 concentration	Increased respiratory disease death rates in areas of intermediate and high SO_2 concentration, within a socioeconomic status, without a consistent mortality gradient between the areas of intermediate and high SO_2 concentration.
Watanabe and Kaneko (1971)	1965/1966 mortality rates in Osaka, Japan, stratified by degree of air pollution	Stepwise increase in total mortality and deaths from circulatory disease in areas of greater pollution.

the 4 air-pollution strata. A mortality gradient was also observed across socioeconomic strata within the same air-pollution category. For ages 70 and over, the mortality gradient across air pollution strata persisted, whereas the gradient across socioeconomic categories was no longer found. These results must be interpreted with considerable caution because of several shortcomings in the quality of the available data. Restriction of the study to a broad age range, 50 to 69 years, without age adjustment, does not remove the possibility that a larger proportion of older men in the 50 to 69-year range lived in the more polluted or poorer economic census tracts and were therefore more likely to experience greater mortality rates. Allocation of each census tract into 1 of the 5 socioeconomic categories was based on median family income of the census tract. This method does not permit adjustments for the actual socioeconomic status of individual decedents. No information was available on smoking habits or occupation of the study population, and these factors may also have been unevenly distributed among pollution and socioeconomic categories, thus confounding the observed associations. These considerations highlight the difficulties in interpreting associations between air pollution and geographic differences in mortality rates.

Nevertheless, the array of studies on the sulfur oxide/particulate type of pollution from various parts of the world in different years implies a relatively consistent association between long-term residence in more polluted communities and increased mortality rates. It is unlikely that smoking habits would consistently follow a geographic air pollution gradient. Population mobility tends to decrease the likelihood of finding an air-pollution effect, because the contrast between heavy and light exposure will be diminished by persons moving from light- to heavy- and from heavy- to light-pollution communities. There may have been some correlation between the proportion of the population involved in high-risk occupations and residing in areas of heavy pollution, particularly in analyses of male mortality rates, because heavily industrialized areas are often heavily polluted as well. Thus, the consistency of the air pollution/mortality associations does not imply causality because intervening factors have not been eliminated in most of these studies.

Chronic Respiratory Disease

Symptom Prevalence and Air Pollution Exposure. Identifying the contribution of air pollution to the development of chronic obstructive respiratory diseases (chronic bronchitis, emphysema, and others) introduces difficulties similar to those cited in the previous section: (*1*) isolating the effects of air pollution from

TABLE 4

AVERAGE ANNUAL DEATH RATES PER 1,000 POPULATION FROM ALL CAUSES ACCORDING TO ECONOMIC STATUS AND PARTICULATE CONCENTRATIONS, AND AGE: WHITE MEN, 50-69 YEARS OF AGE, BUFFALO, N. Y., AND ENVIRONS, 1959-1961*

Economic Status	*Particulate Concentration*			
	1 (Low)	*2*	*3*	*4 (High)*
1 (low)	–	36	41	52
2	24	27	30	36
3	–	24	26	33
4	20	22	27	–
5 (high)	17	21	20	–

*Winkelstein *et al.* (1962).

other contributing factors, particularly cigarette smoking, occupational exposures, and previous infections, and (2) comparing results of studies conducted by different investigators in various parts of the world. The need for a uniform set of criteria for characterizing chronic respiratory disease led to the development of standardized questionnaires pioneered by the British Medical Research Council (Medical Research Council, 1960 and 1965). These questionnaires in the original or modified forms have been widely used in population studies since the early 1960s and have been translated into several languages. The questionnaires provide information on chronic respiratory symptoms, smoking habits, occupational exposures, and usually socioeconomic, and demographic characteristics of respondents. Measurements of lung function often accompany use of the questionnaire. Although there are problems of reproducibility (Holland *et al.*, 1966), the questionnaires led to a considerable degree of standardization and comparability of the results of different investigators.

Most studies of chronic respiratory disease and air pollution conducted throughout the world have indicated a relationship between the prevalence of chronic respiratory symptoms and the sulfur oxides/particulate complex. These data are presented in table 5.

The investigation by Lambert and Reid (1970) of nearly 10,000 British residents 35 to 69 years of age is illustrative of a carefully designed and executed epidemiologic study relating smoking habits, age, sex, and air pollution by current residence to the prevalence of chronic respiratory symptoms. Symptoms were ascertained in 1965 by mailing a version of the Medical Research Council questionnaire to a random sample of 35- to 69-year-old residents of England, Wales, and Scotland, categorized according to region and degree of urbanization. Increasing prevalence of persistent cough and phlegm and of chronic bronchitis with age and cigarette consumption was confirmed. Urban/rural differences were not explained by smoking differences alone. As shown in figure 2, age-standardized prevalence rates for symptoms increased with heavier air pollution, independently of cigarette smoking. However, the gap between prevalence rates of nonsmokers and smokers widened as the degree of air pollution increased, suggesting that "the joint influence of pollution and smoking on the level of the prevalence-rate is greater than the sum of their separate effects" (Lambert and Reid, 1970). Air pollution at the current residence of each respondent was derived by classifying

TABLE 5

STUDIES OF AIR POLLUTION AND PREVALENCE OF CHRONIC RESPIRATORY SYMPTOMS

Study	*Characteristics*	*Findings*
Fairbairn and Reid (1958)	Comparison of respiratory illness among British postmen living in areas of heavy and light pollution	Sick leave, premature retirement, and death due to bronchitis or pneumonia were closely related to pollution index based on visibility.
Ferris and Anderson (1962), Anderson and Ferris (1965)	Questionnaire and ventilatory function survey of random sample of adult population in Berlin, N. H., and Chilliwack, British Columbia, 1961–1963	No apparent excess in symptom prevalence in association with air pollution. Diminished pulmonary function in residents of more polluted community, although differences in occupation, climate and ethnic factors may account for these findings.
Mork (1962)	Questionnaire and ventilatory function tests of male transport workers 40–59 years of age in Bergen, Norway and London, England	Greater frequency of symptoms and lower average peak flow rates in London. Differences were not explained by smoking habits or socioeconomic factors.
Holland *et al.* (1965), Deane *et al.* (1965)	Questionnaire and ventilatory function survey of outdoor telephone workers 40–59 years of age in London, rural England, and on the east and west coasts of U. S.	Increased prevalence of respiratory symptoms, adjusted for smoking and age, a larger volume of morning sputum and a lower average ventilatory function in London workers, and in the English compared with American workers. No differences in symptom prevalence between San Francisco and Los Angeles workers, although particulate concentrations were approximately twice as high in Los Angeles.
Ministry of Pensions and National Insurance (1965)	Incidence survey of worker incapacity from bronchitis and other illness in representative samples throughout Britain, 1961/1962	Incapacity due to bronchitis correlated with winter concentrations of smoke and SO_2 in each of four 10-year age groups. Socioeconomic and other characteristics of the areas may have contributed to the associations.
Petrilli *et al.* (1966)	1961/1962 study of respiratory symptoms in nonsmoking women 65 years of age and over who had not worked in industry and were long-time residents of their neighborhood in Genoa, Italy	Strong association between chronic respiratory symptom prevalence and area gradient for particulates and SO_2. Comparability between residents of surburban and industrialized areas was not assured by exclusion of persons on social welfare assistance.
Cederlof (1966), Hrubec *et al.* (1973)	Chronic respiratory symptom prevalence in large panels of twins in Sweden and in the U. S. Index of air pollution based on estimated residential and occupational exposures to SO_2, particulates, and CO	Increased prevalence of respiratory symptoms in twins related to smoking, alcohol consumption, socioeconomic characteristics, and urban residence, but not to indices of air pollution.
Bates *et al.* (1962, 1966), Bates (1967)	Comparison of symptom prevalence, work absences, and ventilatory function in Canadian veterans residing in 4 Canadian cities	Lower prevalence of symptoms and work absences and better ventilatory function in veterans living in the least polluted city.
Bates (1973)	10-year follow-up study of Canadian veterans initially evaluated in 1960, and followed at yearly intervals with pulmonary function tests and clinical evaluations	Least decline in pulmonary function with age in veterans from least polluted city.
Yashizo (1968)	Bronchitis survey of 7 areas of Osaka, Japan, 1966, among adults 40 years of age and over	Bronchitis rates, standardized for sex, age, and smoking were greater among men and women in the more polluted areas. Bronchitis rates followed the air pollution gradient.

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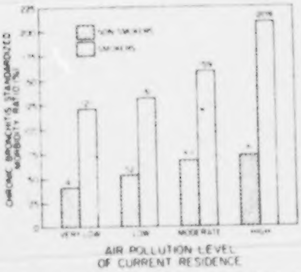


Fig. 2. Prevalence of chronic bronchitis in relation to smoking and air pollution. Source Lambert and Reid, 1970.

each area of Britain into 1 of 4 air-pollution categories on the basis of an index of domestic coal consumption in 1952 and on measurements of SO_2 and smoke in 1965. The latter measurements were available in only 30 per cent of the residential areas of the respondents. There is some evidence that lower-social-class populations were under-represented in this study, which suggests a biased response. The authors also did not take social-class differences between air pollution areas into account, and it is not known whether this factor may have confounded the observed relationship.

As is evident from the studies cited in table 5, interpretations of an observed association between air pollution exposure and prevalence of chronic respiratory disease are often complicated by many potential confounding factors, particularly smoking, socioeconomic characteristics, occupational exposures, and selective migration of populations into or out of polluted areas. Not infrequently, populations at greater risk of chronic respiratory disease due to occupation, social class, or crowding tend to reside in more polluted localities. Changes in residence, occupation, and smoking habits further complicate air pollution studies, especially those that attempt to follow a population for prolonged intervals. When adjustments are made for potential confounders, the association of respiratory-disease prevalence with air pollution frequently becomes considerably diminished, and it is difficult to determine whether the effect of air pollution is really quite small or whether the effects were over-adjusted for some of the confounding factors.

Attempts to determine what degree of air pollution exposure might be related to increased risk of chronic respiratory disease are beset with even greater obstacles. In many studies, no direct measurements of air pollution were available. In

TABLE 5 *(Continued)*

Study	*Characteristics*	*Findings*
Winkelstein and Kantor (1969)	Survey of respiratory symptoms in a random sample of white women in Buffalo, New York	In nonsmokers 45 years of age and over, and among smokers who did not change residence, respiratory symptoms were correlated with particulate concentrations obtained in the neighborhood of residence. No association of symptom prevalence with SO_2 concentrations.
Ishikawa *et al.* (1969)	Comparison of lungs obtained at autopsy from residents of St. Louis and Winnipeg	Autopsy sets, matched for age, sex and race, showed more emphysema in the more polluted city. Autopsied groups may not reflect prevalence of disease in general population.
Fujita *et al.* (1969)	Prevalence survey (Medical Research Council questionnaire) of post office employees in Tokyo and adjacent areas, 1962 and re-surveyed in 1967	Two-fold increase over time in prevalence of cough and sputum production in same persons, irrespective of smoking habits. Change was attributed to increasing degrees of air pollution.
Sawicki (1969a, b), Sawicki and Lawrence (1977)	Prevalence of chronic respiratory disease in a probability sample of 19- to 70-year-old residents of Cracow, Poland, surveyed in 1968 and again in 1973	Prevalence of chronic respiratory symptoms, adjusted for age, sex, and smoking habits, in 1968 and 1973 and persistence of these symptoms during 5 years was greater in high pollution areas only in men 31–50 years of age, in older women, and in smokers of both sexes. No distinct association of ventilatory function with degrees of air pollution.
Lambert and Reid (1970)	Postal survey of nearly 10,000 British residents, 35–64 years of age using standardized questionnaire	Among smokers, prevalence of chronic respiratory symptoms increased with increasing air pollution. Lesser symptom/pollution association in smokers.
Reichel (1970), Ulmer *et al.* (1970)	Respiratory morbidity prevalence surveys of random samples of population in 3 areas of West Germany with different degrees of air pollution	No differences in respiratory morbidity, standardized for age, sex, smoking habits, and social conditions, between populations living in the different areas.
Nobuhiro *et al.* (1970)	Chronic respiratory symptom survey of high and low exposure areas of Osaka and Ako City, Japan	Higher prevalence of chronic respiratory symptoms in more polluted areas.
Ferris *et al.* (1971, 1973, 1976)	Repeat survey in 1967 of residents of Berlin, N. H., 6 years after the original 1961 study and again in 1973, 12 years after the original study. TSP* concentrations decreased from 180 μg per m^3 in 1961 to 90 μg per m^3 in 1973	Slightly lower prevalence of chronic respiratory symptoms and improved ventilatory function tests in the 1967 survey after standardization for age, sex and smoking habits. Results were attributed to decrease in air pollution values, although some of the effects may be associated with differences in temperature and season between the 1961 and 1967 surveys. No differences in chronic respiratory symptom prevalence found in 1973, even though air quality continued to improve.
Tsunetoshi *et al.* (1971)	Prevalence survey (Medical Research Council questionnaire) of 9 areas of Osaka and Hyogo prefectures, Japan, residents 40 years of age and over	Multiple regression analysis revealed increasing prevalence of chronic bronchitis, adjusted for age, sex, and smoking, corresponding to the the area gradient of air pollution.
Cohen *et al.* (1972a)	Symptom and ventilatory function survey of nonsmoking Seventh Day Adventists 45–64 years of age in Los Angeles and San Diego	No association of symptom prevalence or ventilatory function with differences in peak oxidant readings of the 2 areas.
Chapman *et al.* (1973)	1970/1971 prevalence survey of chronic respiratory symptoms in adult parents of school children in New York, Salt Lake City area, 5 Idaho-Montana communities, and Chattanooga; and of military	Increased prevalence of chronic respiratory symptoms in nonsmokers and smokers residing in more polluted communities. Effect of cigarette smoking exceeded that of air pollution. No association of

Health Effects

TABLE 5 *(Continued)*

Study	*Characteristics*	*Findings*
	inductees in the Chicago metropolitan area	symptoms with nitrogen oxide pollution in Chattanooga
Comstock *et al.* (1973)	Repeat survey in 1968/1969 of east coast telephone workers and of telephone workers in Tokyo	After adjustment for age and smoking, no significant association of respiratory symptom prevalence with place of residence.
Speizer and Ferris (1973a and b)	Comparison of respiratory symptoms and ventilatory function in central city and suburban Boston traffic policemen	Slight but insignificant increase in symptoms prevalence among nonsmokers and smokers, but not exsmokers, from the central city group. No group differences in ventilatory function.
Becklake *et al.* (1975)	Prevalence of respiratory symptoms and measurement of ventilatory function in adults and children living in 3 areas of Montréal having different degrees of particulate air pollution (84 to 130 μg per m^3 in 1974)	No difference in symptom prevalence or ventilatory function related to the degrees of air pollution in the 3 communities.
Linn *et al.* (1976)	Respiratory symptoms and function in office working population in Los Angeles and San Francisco, 1973	No significant difference in chronic respiratory symptom prevalence between cities; women in the more polluted community more often reported nonpersistent (< 2 years) production of cough and sputum.
Neri *et al.* (1976)	Comparison of respiratory disease prevalence and ventilatory function in residents of Sudbury (affected by pollution from large nickel and copper smelting operations) and Ottawa, Ontario	After adjusting for smoking, age, and occupation, residence in Sudbury was associated with excess respiratory disease and diminished ventilatory function. No information provided on effects of differences in season, years, or observers between the 2 cities.

*Total suspended particulate.

those that did have the benefit of measurements, exposures were seldom determined in close proximity to the place of residence. Similarly, methods of measurement are not well standardized, and comparison of results from one study to another is often bedeviled by incompatible air pollution data. Chronic respiratory disease appears to develop in response to cumulative insults that include smoking intensity, recurrent respiratory diseases in childhood, and occupational dusts. Air-pollution measurements obtained at the time populations are surveyed for the prevalence of chronic respiratory disease may bear little relationship to the concentration or type of pollution that may have contributed to the development of this disease, nor may the measured air pollutants be the most appropriate in terms of disease risk.

In the face of these methodologic difficulties, the health community is hard pressed to reach consensus on a pollutant concentration that may increase the risk of chronic respiratory disease. The evidence is qualitative at best; i.e., heavy concentrations of sulfur oxide/particulate pollution appear to increase the public health risk of chronic respiratory disease, smoking is a dominant factor in the etiology of this disease, and air pollution probably adds a small part to the over-all risk of this disease. As we attempt to determine the lowest concentration at which air pollution contributes to this risk, the role of confounding factors becomes larger and Interpretations become more difficult. Because animal studies can make little contribution to quantitative human risk assessments, and because experimental human studies are generally appropriate only for short-term effects, it is unlikely that we can overcome these methodologic limitations and achieve general consensus on the quantitative contribution of air pollution to the risk of chronic respiratory disease.

Exacerbation of Disease in Chronically Ill Persons. The effect of air pollution on persons with chronic respiratory disease is particularly important to study from a public health viewpoint because these persons are believed to include a segment of the population extremely susceptible to air-pollution exposure. Air quality standards based on protection of public health should be established to provide adequate protection for these susceptible groups. Many investigators have studied the temporal pattern of symptom status in these persons in relationship to concentrations of air pollution and weather factors.

In the follow-up study by Ciocco and Thompson (1961) 9 years after the 1948 Donora air pollution episode, it was learned that most of the excess mortality and morbidity occurred in persons who had chronic illness before the episode. This suggests that the episode's main effect was exacerbation of pre-existing disease rather than initiation of new disease.

An extensive series of studies on the effects of air pollution on bronchitic patients attending chest clinics was conducted in Britain between 1955 and 1970 and has been summarized in a paper by Lawther, Waller, and Henderson (1970). These studies show that exacerbations of disease were associated with high concentrations of smoke and SO_2, although aggravation of disease was more clearly associated with relative increases rather than absolute concentrations of pollution. The concentrations of SO_2 and smoke were too closely correlated to differentiate between the effects of these pollutants. With decreasing concentrations of pollutants in the British atmosphere, it has been difficult since 1969 to relate changes in the subjects' symptom status that could be attributed to variations in concentrations of air pollution.

Further, in the United Kingdom examination of sickness absence records (Clifton *et al.*, 1959; Gregory 1970), of rates of physician consultation (Carne, 1964) and of daily records of hospital admissions through the emergency service (Martin, 1964), showed associations with periods of heavy air pollution. By contrast, Emerson (1973) found no relationship between weekly changes in ventilatory function of 18 patients with chronic obstructive lung disease and concentrations of smoke or SO_2 on the day of testing and the 4 previous days.

Beneficial effects of improved air quality have been suggested in the studies of Fletcher and associates (1968) and Howard (1974), who followed patients with obstructive airway disease and observed a general decrease in sputum production or less respiratory dysfunction in association with a decrease in degrees of pollution in London and Sheffield, respectively, between 1960 and 1970. It is also possible that changes in the tar content of cigarettes and the use of cigarette filters may have accounted for some or all of these effects. In a latter report on their follow-up of patients with obstructive airway disease, Fletcher and associates (1976) state that because of learning effects and changes in techniques of sputum volume measurements, "It is impossible to establish . . . whether a secular decrease in chronic mucus hypersecretion did occur in our population during the 1960s."

Studies performed in the United States have shown variable results in attempts to relate days of increased air pollution with exacerbation of disease in persons with chronic respiratory symptoms. Burrows and co-workers (1968) evaluated the symptom status of 115 patients with chronic obstructive lung disease in Chicago during 2 years, 1963 to 1964, and examined the relationship of symptom changes with environmental conditions that included measurements of SO_2 at a single monitoring station. Although a high correlation between symptom status and SO_2 was observed, low temperatures were shown to be the dominant factor, and little influence of SO_2 was seen when the temperature effect was taken into account. Carnow and associates (1969) likewise studied 500 patients with bronchopulmonary disease in Chicago from October through December 1967. These investigators reported a significant relationship between SO_2 concentrations of 1 day and symptom rates on the next day in men 55 years of age and older with more severe bronchitis, but not in younger men or women or in patients with less severe disease. Although Carnow and associates (1969) estimated the exposure of each person from measurements provided by the entire Chicago air monitoring networks, their symptom rates were not adjusted for temperature or seasonal factors. Particulate matter, although not reported by the authors, no doubt also played a role.

Spicer and Kerr (1966) noted that airway resistance in patients with obstructive lung disease living in Baltimore showed similar day-to-day patterns of change; this pattern could not be explained by any 1 environmental pollutant or weather variable. Nevertheless, the authors concluded that some common environmental factor appeared to be affecting the patients as a group.

Bates and associates (1962, 1966) performed serial examinations of Canadian veterans with chronic obstructive lung disease living in 4 Canadian cities and reported that the veterans living in the least polluted city had better lung function and were less severely affected during a 4-year period than were those in the other 3 cities. Goldberg and co-workers (1974) also observed an association between symptom status and particulate sulfates in elderly subjects with pre-existing heart and lung disease living in 3 communities in and near New York City; symptom rates were adjusted for temperature variations. However, drop-out rates were quite high during the course of the study, 1971 to 1972, and other methodologic problems were encountered, particularly with the adequacy of particulate monitoring.

On the whole, studies of the symptom status of patients with chronic obstructive lung disease show relationships between disease status and air pollution concentrations at relatively high concentrations of SO_2 and particulates. Frequently, low temperatures exert a greater effect than does air pollution, and the similar temporal pattern of air pollution and cold temperatures in the past may have accounted for some of the observed air pollution/disease aggravation relationships. Two of the studies, Carnow and associates (1969) and Spicer and Kerr (1966), suggested that effects of heavy pollution continued for 36 to 72 hours. The British studies suggest that improvements in air quality during the past 20 years in England have largely abated the air pollution/disease aggravation relationships. In the United States, similar longitudinal studies to confirm these findings have not been conducted. In any case, a return to previously higher concentrations of pollutants would appear to increase the risk of exacerbations for persons with the obstructive airway disease.

TABLE 6

AIR POLLUTION AND BRONCHIAL ASTHMA

Study	*Characteristics*	*Findings*
Schrenk *et al.* (1949)	Retrospective study of respiratory symptoms during the 1948 Donora air pollution episode	87.6% of asthmatics, 77.2% of persons with heart disease, and 42.7% of the general population of Donora reported respiratory symptoms during the episode.
Schoettlin and Landau (1961)	137 asthmatics reporting attacks on daily occurrence of asthma, September–December 1956, in the Los Angeles Basin	Significantly more asthma on days of heavier oxidant pollution. No adjustment was made for variations in temperature or season.
Zeidberg *et al.* (1961)	Study during 1 year of 49 adults and 34 children with asthma in Nashville, Tenn.	Doubling of asthma attack rates in persons living in more polluted neighborhoods. No adjustment for demographic or social factors.
Cowan *et al.* (1963)	History of asthma, and skin tests of University of Minnesota students, in relation to dust from nearby grain elevator	Significant association between grain-dust exposure and asthma attacks
Greenburg *et al.* (1964)	New York City hospital emergency room visits for asthma in month of September	Emergency room visits strongly associated with onset of cold weather but not with degrees of air pollution during the one month of study.
Weill *et al.* (1964), Carroll (1968)	Retrospective study of emergency room visits to New Orleans Charity Hospital	Periodic "epidemics" of asthma in New Orleans could not be traced to any common pollutant exposure.
Phelps (1965), Meyer (1976)	"Tokyo-Yokohama asthma" in American servicemen stationed in Japan after World War II	Disease primarily in smokers attributed to allergic response to atmospheric substances that could not be characterized. Patients improved after leaving the area and were immediately affected on return. Some had long-term effects afterwards.
Glasser *et al.* (1967)	Emergency room visits in 7 New York City hospitals during the November 1966 air pollution episode	Increased emergency room visits for asthma in 3 of 7 hospitals studied.
Sulz *et al.* (1970)	Hospitalizations for asthma (1956–61) and for eczema (1951–61) in Erie County, N. Y. Attack rates of patients stratified into air pollution/social class categories	Area gradients in asthma and eczema hospitalization rates, adjusted for social class differences, corresponded to the air pollution gradient. Meterological differences between areas not analyzed.

Air Pollution and Bronchial Asthma

Persons with asthma represent another segment of the population that appears to be particularly susceptible to short-term peak concentrations of air pollutants. By surveying the inhabitants of Donora, Pennsylvania after the 1948 air-pollution episode, Schrenk and associates (1949), as shown in table 6, found that 88 per cent of those persons with asthma, 77 per cent of those with heart disease, and 43 per cent of the general population reported respiratory symptoms during the episode. Other studies have recorded increased emergency room visits for persons with asthma during air pollution episodes (Glasser *et al.*, 1967; Chiaramonte, 1970) and during other times of increased air-pollution concentrations (Goldstein and Block, 1974). However, several studies have failed to find an association of emer-

TABLE 6 *(Continued)*

Study	*Characteristics*	*Findings*
Chiaramonte *et al.* (1970)	Emergency room visits at a Brooklyn hospital during a November 1966 air pollution episode	Statistically significant increase in emergency room visits for asthma and for all respiratory diseases, continuing to 3 days after the peak air pollution concentrations
Derrick (1970)	Nighttime emergency room visits for asthma in Brisbane, Australia	Negative correlation between asthma visits and degrees of smoke shade.
Cohen *et al.* (1972b)	Daily diaries kept by 20 asthmatics* for 7 months in small town located close to a coal-fired power plant on the Ohio–West Virginia border.	Temperature-adjusted attack rates were significantly correlated with each measure of air pollution (various particulate and gas concentrations). No one pollutant accounted for the association.
Rao (1973)	Pediatric emergency room visits for asthma at Kings County Hospital, Brooklyn, October 1970–March 1971	Negative correlation of asthma visits with degrees of smoke shade. Lack of temperature adjustments. Considerable distance of hospital district from air monitoring stations.
Goldstein and Block (1974)	Emergency room visits for asthma at a hospital in Harlem and in Brooklyn, New York, September–December 1970 and September–December 1971	Temperature adjusted asthma rates positively correlated with SO_2 values in Brooklyn but not in Harlem. In 1971 period, 50–90% increase in asthma visits on 12 days of heaviest pollution.
Finklea *et al.* (1974c)	Daily diaries kept by 50 asthmatics in each of 3 New York City area communities, October 1970–May 1971	Temperature-adjusted attack rates significantly correlated with total particulates in 2 of the communities. Increase in relative risk from days of light to heavy pollution was relatively small. High turnover in reporting panels.
Yoshida *et al.* (1976)	Prevalence of bronchial asthma in elementary school children in 3 polluted areas of Japan (Fuji City, Chiba Prefecture, Tokyo) and one area of light pollution (Saku City), 1964–1972	Prevalence of asthma in polluted areas twice as great as in area of light pollution. Increase of asthma in Chiba Prefecture from 0.56% in 1964 to 2.02% in 1972. Comparison of asthmatic children in both areas revealed no differences in seasonal incidence, frequency or severity of attacks, school absence rates, or eosinophilia; significantly more colds and lower gamma globulin concentrations in asthmatics from area of heavy pollution.

gency-room visits for asthma with varitions in air pollution (Greenburg *et al.*, 1964; Weill *et al.*, 1964; Derrick, 1970; Rao, 1973), although these analyses generally did not take into account the important contributions of daily temperature and season of the year.

As reported by Cohen *et al.* (1972b), most persons with asthma do not routinely go to an emergency room or even see a doctor for treatment of their asthmatic episodes. Thus, it is important to evaluate the contribution of air pollution to asthma attacks from data sources other than the records of emergency rooms or clinics. Such studies have been carried out by Schoettlin and Landau (1961) in relation to photochemical air pollution, by Cohen and associates (1972b), and by Finklea and co-workers (1974c, 1974d) for particulate and sulfur-oxide air pollution. In these studies, daily diaries were kept by panels of asthmatic subjects, and asthma frequency was studied in relation to temperature, season, and various air-pollution measurements. The analyses tend to show a gradient of response between asthma attacks and days with lower temperature or with greater air-pollution concentrations. In general, minimal daily temperature was more strongly correlated with attack rates, but when rates adjusted for temperature were computed, air-pollution concentrations still exerted a significant effect. Some potential intervening factors, such as atmospheric pollens, temperature changes on the same day, and psychologic stress, were not or could not be measured.

The effects of short-term changes in meteorologic conditions on frequency of asthma attacks have been reported from the Netherlands by Tromp (1968). Persons with asthma appear to experience increased attack rates when cold fronts move into an area on the heels of a warm weather system. The rapid decreases in temperatures, which are also associated with sudden decreases in barometric pressure, were shown to have the greatest effect on rates of asthma attack.

Several investigators have reported an increased asthma prevalence or frequency of attacks in persons living in more polluted communities (Zeidberg *et al.*, 1961; Sultz *et al.*, 1970, Yoshida *et al.*, 1976). These differences may be attributed to air pollution, differential mobility of persons with asthma, meteorologic or allergenic substances, or combinations of these factors. In some cases, environmental factors appeared to play a role, but specific agents could not be identified, as in New Orleans (Weill *et al.*, 1964; Carroll, 1968) and in the "Tokyo-Yokohama asthma" of American servicemen stationed in Japan (Phelps, 1965; Meyer 1976).

The marked variability of persons with asthma in response to numerous precipitating factors such as exogenous allergens, respiratory infections, cold fronts, smoke and dust, psychological factors, and season of the year, renders difficult the interpretation of results of air pollution studies. It is very difficult to account for all of these precipitating factors in any one study. There is much to be learned about the endogenous milieu of the asthmatic subject that may predispose him or her to a hyperreactive state when exposed to the same external challenge at one time, but not at another.

The asthmatic person appears to represent an extreme on the scale of respiratory sensitivity to external stimuli, and the sum of studies listed in table 6 indicates that increased concentrations of air pollution are 1 of many factors that may precipitate attacks in some persons with asthma. The evidence suggests a continuum in the dose-response relationship, with increasing numbers responding at higher concentrations, but with other intervening factors such as minimal temperature and season greatly modifying this dose-response relationship.

Acute Respiratory Disease

Acute Respiratory Illness in Adults. An experimental basis for a relatonship between air pollution and impaired resistance to respiratory infections has been established in laboratory animals by the work of many investigators. Mice infected with respiratory pathogens and exposed to SO_2 (Fairchild *et al.*, 1972), ozone (Coffin and Gardner, 1972), or nitrogen dioxide (NO_2) (Ehrlich and Henry, 1968) have experienced increased mortality and diminished resistance to infection when compared with infected but unexposed animals. Similarly, several epidemiologic studies have observed an increased incidence of acute respiratory illness in populations living in more polluted communities of the sulfur oxide/particulate category. The relationship is of particular public health significance because infections of the respiratory tract account for a significant portion of total illness in the general population and exact a large economic toll in terms of time lost from school or work, visits to doctors, and admissions to hospitals.

TABLE

AIR POLLUTION AND ACUTE RESPIRATORY DISEASE IN ADULTS

Study	*Characteristics*	*Findings*
Dohan and Taylor (1960), Dohan (1961)	Incidence of respiratory illness lasting 7 or more days, among women RCA employees in 5 U. S. cities, 1957–1960	High correlation between sulfation rates in the air of the 5 cities and the incidence of acute respiratory illness. Effects of season and temperature were not considered.
Angel *et al.* (1965)	Attack rates of minor respiratory illness among 85 London workers, examined every 3 weeks October 1962–May 1963	Attack rates were associated with weekly average smoke and SO_2 concentrations.
Sterling *et al.* (1966, 1967)	Hospital admissions for "relevant" diseases in Los Angeles compared with various measures of air pollution	Significant correlation of respiratory illness admissions with SO_2. However, concentrations of SO_2 were low throughout the study. Decreases in allowable SO_2 emissions in Los Angeles occurred at the same time of the year that admissions for respiratory illness usually decrease.
McCarroll *et al.* (1967), Cassell *et al.* (1969)	Frequency of cough and eye irritation in a New York City population living close to an air monitoring station	Maximal effect on cough frequency occurred 1 or 2 days after peak air pollution concentrations.
Lebowitz *et al.* (1972)	Subset of persons from above study (McCarroll *et al.*, 1967) who appeared to be more reactive to meteorologic and air pollution variations	Complex interactions between weather and pollution in contributing to a greater incidence of acute respiratory symptoms.
Ipsen *et al.* (1969)	Comparison of weekly industrial absence rates 1960–1963 in plants in Philadelphia and Camden, N. J. with air pollution and meteorologic factors. Based on data of Dohan and Taylor (1960) and Dohan (1961)	Strongest correlation of respiratory disease incidence with sulfation rates, but the association appeared to be explained by the common influence of season and climate on pollution and respiratory illness.
Verma *et al.* (1969)	Daily respiratory disease absence rates in white collar workers employed in a New York City insurance company, 1965–1967	Close association between daily absence rates and SO_2 and particulate concentrations, with lag periods of 1 to 7 days between pollution measurement and absence rate. Adjustment for season of year did not eliminate the association.
Love *et al.* (1974)	Incidence of acute respiratory disease, determined at 2-week intervals, in 3 New York City area communities, September 1970–May 1971	Increased frequency of acute lower respiratory tract illness in adults living in the 2 more polluted communities. Illness rates adjusted for social class, smoking, residential mobility, and past history of bronchitis. No association of air pollution with upper respiratory tract disease.
Finklea *et al.* (1974a and b)	Incidence of acute respiratory disease, determined at 2-week intervals, in parents of nursery school children residing in Chicago, December 1969–November 1970	Acute lower respiratory illness rates were significantly lower among families living in neighborhoods where air pollution had been substantially decreased. Rates were adjusted for social class, smoking, residential mobility, and season of year.
Levy *et al.* (1977)	Hospital admissions for respiratory disease in Hamilton, Ontario correlated with sulfur oxide/particulate air pollution index	Increased hospital admissions on heavy pollution days, except at 1 hospital far removed from major pollution sources.

In a number of studies, as shown in table 7, investigators have observed an increased incidence of acute respiratory illness among adults living in more polluted communities. Incidence of illness was variously recorded, through records of work absences (Dohan and Taylor, 1960; Ipsen *et al.*, 1969; Angel *et al.*, 1965; Verma *et al.*, 1969), hospital admissions (Sterling *et al.*, 1966), or repeated personal contact with study subjects (McCarroll *et al.*, 1967; Lebowitz *et al.*, 1972; Love *et al.*, 1974; Finklea *et al.*, 1974a and 1974b). In some studies, crowding, time of the year, or other variables may have influenced the association. The frequency of acute respiratory illness is markedly greater in the autumn and winter months than in summer. Thus, there is a potential for confounding the effects of season of the year with air pollution concentrations, to the extent that air quality may deteriorate in the fall and winter months because of increased domestic fuel consumption. The confounding effect of season can be removed by adjusting illness rates for temperature or season. These factors were taken into account in the studies of Ipsen *et al.* (1969), Verma *et al.* (1969), Lebowitz *et al.* (1972), Love *et al.* (1974) and Finklea *et al.* (1974a and 1974b). Comparison of rates of illness in different exposure communities also requires adjustment for the effects of social class; in general, the studies listed in table 7 either compared groups of the same social class, e.g., hourly white-collar workers, or adjusted the illness rates for differences in social class.

The sum of these studies supports an association between increased acute lower-respiratory tract disease (acute bronchitis, pneumonia, and other acute chest illnesses) in adults and residence in more polluted communities of the sulfur oxide/particulate category. The evidence does not consistently support an association with upper respiratory tract disease (common cold, pharyngitis, laryngitis); several studies have had positive findings and several have been negative on this relationship. The pollutants or concentrations in the presence of which increased risk of acute illness occurs have not been established, and it is difficult to implicate a specific concentration, given the many environmental and personal factors that contribute to a population's risk of acute respiratory illness.

Respiratory Illness in Children. As early as the 1952 London fog episode, it was observed that infants experienced an increase in mortality from respiratory disease; this effect was not manifested in older children (Royal College of Physicians of London, 1970). In reviewing the factors that favor the onset of bronchitis in British children, Reid (1969) noted that cohorts suffering relatively high death rates in childhood also had high rates from the same disease in adult life, which suggested that populations exposed during early life to conditions causing high respiratory mortality continue to experience excess risk of respiratory disease and death throughout life.

As shown in table 8, an impressive number of studies has consistently demonstrated an association between acute respiratory illness rates in children, particularly illnesses of the lower respiratory tract, with residence in more polluted communities affected by the sulfur oxide/particulate category. These excess illness rates cannot be accounted for by social class or area differences in residential mobility, because these factors were taken into account. In several of the studies listed in table 8, the frequency and severity of acute lower respiratory disease increased with the degree of air pollution (Lunn *et al.*, 1967; Douglas and Waller, 1966; **Colley and Reid, 1970; Irwig *et al.*, 1975**), and appeared to diminish when air quality was improved (Lunn *et al.*, 1970, Colley and Reid, 1970).

The evidence for an association between upper respiratory tract disease and air pollution is not nearly as consistent. Lunn and associates (1967) and Finklea and co-workers (1974a) reported an association, whereas Douglas and Waller (1966), Colley and Reid (1970), and Love and associates (1974) failed to find such a relationship in distinguishing between upper and lower respiratory tract illness.

In a major, long-term prospective study, British investigators have followed a cohort of children born throughout England and Wales in March 1946; this cohort was surveyed at periodic intervals for respiratory symptoms and smoking habits, to 20 years of age (Colley and Reid, 1970) and 25 years of age (Kiernan *et al.*, 1976). An association between the prevalence of current cough and lower respiratory illness in childhood and current smoking habits was observed in each follow-up, and the association appeared to increase in strength over time. At 20 years of age, however, the prevalence of cough (adjusted for social class and current smoking) was associated with a heavier air pollution index only for lower social classes. At 25 years of age, the effect of air pollution index was somewhat more apparent, but still less so than that of current smoking and history of childhood illness. Thus, although the cumulative evidence does implicate a greater risk of acute lower respiratory illness among children residing in more polluted areas, this risk is not uniformly manifested in young adulthood and is of lesser magnitude than the risk associated with cigarette smoking.

Air Pollution and Ventilatory Function

Geographic differences in various air pollution indices have frequently been related to ventilatory function, particu-

TABLE 8

AIR POLLUTION AND RESPIRATORY DISEASE IN CHILDREN

Study	*Characteristics*	*Findings*
Douglas and Waller (1966)	Evaluation of more than 3,000 children 15 years of age, born in March 1946 in England and Wales and followed regularly as part of a comprehensive health survey. Social class was generally equal among the air pollution categories	Lower respiratory infections were consistently related to an area index of pollution; frequency and severity of illness increased with pollution index across areas. No association with upper respiratory illness.
Lunn *et al.* (1967, 1970)	Respiratory illness in 5-year old children living in 4 districts of Sheffield, England, 1963–1965. Study repeated 4 years later on same children	Distinct increase in acute morbidity for both upper and lower respiratory tracts in relation to neighborhood air pollution. Four years later, after improvements in air quality, neighborhood differences in illness had narrowed and were not significant.
Holland *et al.* (1969a, 1969b)	Prevalence of respiratory symptoms, degrees of ventilatory function, and past histories of respiratory illness in more than 10,000 school children 5–16 years of age residing in 4 different areas of northwest London, 1964/1965. Greatest differences among areas were found in degrees of air pollution	Childhood smoking habits and degree of air pollution were found to have the greatest influence on respiratory symptom prevalence and ventilatory function. Social class, family size, and past history of respiratory disease also contributed. All factors operated independently and exerted their effects additively.
Wayne *et al.* (1969)	Absentee rates for respiratory illness in 2 elementary schools in Los Angeles, September 1962–June 1963	No consistent association between weekly oxidant concentrations and weekly absence rates for respiratory disease.
Colley and Reid (1970)	Respiratory disease prevalence in more than 10,000 children 6–10 years old, England and Wales, 1966	Definite gradient of past bronchitis and current cough, from lowest rates in rural areas to highest rates in the most heavily polluted areas. Differences were more clear in children of semi-skilled and unskilled workers. No effect on upper respiratory illness rates.
Colley and Reid (1970), Kiernan *et al.* (1976)	Re-examination at 20 and 25 years of age of the cohorts of children studied by Douglas and Waller (1966) from different areas of England and Wales	Dominant effect of cigarette smoking on respiratory symptom prevalence, followed by a history of lower respiratory tract illness at less than 2 years of age. Air pollution and social class had only small and insignificant effects. Tendency for air pollution effect to be greatest in lower social class.
Shy *et al.* (1970a, 1970b)	Incidence of acute respiratory disease assessed at 2 week intervals, November 1968–April 1969 in school children and families residing in high NO_2 exposure areas of Chattanooga, Tenn.	Respiratory illness rates higher in children and parents of the high NO_2-exposed area. Rates adjusted for age, sex, family size and age composition, social class, and education of head of household. High NO_2 area also had higher sulfates and nitrates than other areas.
Pearlman *et al.* (1971a)	Retrospective survey of acute lower respiratory illness among infants and school children 6–8 years of age residing in high NO_2 exposure areas of Chattanooga, 1966–1969	Bronchitis rates among school children corresponded to an area gradient for NO_2 exposure in people who had lived at their current residence for 3 years. Area differences were not significant among infants but followed a similar pattern of more illness in high NO_2 areas.
Pearlman *et al.* (1971b)	Incidence and duration of influenza-like illness, December 1968–March 1969, among elementary school children residing in 5 southern California communities	No relationship between a community photochemical oxidant gradient and illness rates during an influenza epidemic. Epidemic occurred during a normally low-oxidant period in southern California.
Collins *et al.* (1971)	Death rates in children 0–14 years of age, 1958–1964, in relation to social and air	Partial correlation analysis suggested that indices of domestic and industrial pollution account for a

TABLE 8 *(Continued)*

Study	*Characteristics*	*Findings*
	pollution indices in 83 county boroughs of England and Wales	greater part of the area differences in mortality from bronchopneumonia and all respiratory diseases among children 0–1 year of age
Nelson *et al.* (1974)	Retrospective study of lower respiratory disease frequency in children 0–12 years of age living in 4 communities of the Salt Lake Basin, 1967–1970	Increased frequency of total lower respiratory diseases, croup, and bronchitis (adjusted for age, sex, social class, duration of residence) in children from heaviest pollution area. No significant pollution effect in families with less than 3 years residence in the community. Responses validated against records of physicians.
Finklea *et al.* (1974a)	Incidence of acute respiratory illness, 1969/1970 in Chicago area nursery school children, 2–5 years of age, determined at 2-week intervals. Study population stratified into 3 air pollution categories	Greater incidence of upper and lower respiratory illness among children living in the 2 areas of heavier air pollution. Rates adjusted for social class, residential mobility, season of year, and smoking habits of parents
Finklea *et al.* (1974b)	Retrospective survey of lower respiratory disease in children 0–12 years of age, living in 5 Idaho-Montana communities, 1967–1970	Greater frequency of total lower respiratory disease, croup and bronchitis (adjusted for age, sex, social class, duration of residence) in children from the communities of heaviest pollution exposure. No air pollution effect in families with less than 3 years of residence in the community.
Love *et al.* (1974)	Prospective survey of acute respiratory disease in children residing in 3 communities in the New York City area. Illness rates determined at 2-week intervals, September 1970–May 1971	Increased incidence of lower respiratory tract illness (adjusted for social class, age, sex, smoking habits of parents, residential mobility) in children from the 2 more polluted communities.
Durham (1974)	Student health service visits for respiratory illness among college students at 5 Los Angeles and 2 San Francisco schools, 1970–1971	Illness rates for pharyngitis, bronchitis, and colds were strongly associated with oxidant concentrations of the same day through the 7 preceding days. Stronger associations observed in Los Angeles than in San Francisco.
Irwig *et al.* (1975)	Prospective 4-year study of peak flow rates and respiratory illness in 11,000 children 5–11 years of age from 28 areas of England and Scotland, 1973–1977	During first year of study there was a significant gradient of prevalence of lower respiratory disease corresponding to the air pollution gradient in 10 of the areas studied. Allowance made for differences in age, sex, and social class.
Kerrebijn *et al.* (1975)	1973 survey of respiratory symptoms and ventilatory function in fourth-and fifth-grade school children living in 2 areas of different air pollution in Westland, the Netherlands	Higher prevalence of cough among children living in more polluted area. No area differences in ventilatory function. Economic status, family size, and housing conditions were comparable.
Hammer *et al.* (1976)	Retrospective survey of lower respiratory illness in children 0–12 years of age living in 4 New York City area communities, 1969–1972	Rates of total respiratory illness, croup, bronchitis, and other chest infections were significantly higher among black and white children residing in communities with heavier air pollution. Differences in family size, crowding, parental smoking, and social class could not explain the findings.
Melia *et al.* (1977)	4-year longitudinal study of respiratory symptoms in children 6–11 years of age from 28 randomly selected areas of England and Scotland	Children from homes in which gas was used for cooking had more cough, chest colds, and bronchitis than did children from electric-cooking homes. Effect was independent of age, social class, latitude, population density, family size, or outdoor concentrations of smoke or SO_2.

larly in school children, in studies reported from England, Japan, the United States, Canada, and the Netherlands, as listed in table 9. Ventilatory function in children is a particularly useful measure of air pollution effects, because cigarette smoking, occupational exposures, and frequent changes of residence do not as yet generally play a role in the observed effect. In nearly all reported studies, children residing in more polluted communities of the sulfur oxide/particulate category show diminished ventilatory function when compared with their counterparts—adjusted for age, sex, race, height and social class—living in less polluted areas. Holland and co-workers (1969a and b) observed an independent effect of childhood smoking, air pollution, social class, and past history of respiratory disease on ventilatory function of British schoolchildren, and reported the greatest apparent influence from smoking and air pollution, with all the 4 factors exerting their effects additively. Similar differences have not been consistently associated with photochemical oxidants in California (Schoettlin, 1962; Motley *et al.*, 1959; Rokaw and Massey, 1962; McMillan *et al.*, 1969; Cohen *et al.*, 1972a, Balchum, 1973), whereas in Japan (Kagawa *et al.*, 1975, 1976) and in Tucson, Arizona (Lebowitz *et al.*, 1974) an effect of oxidant pollution on ventilatory function of schoolchildren has been reported, although ambient temperature also appeared to account for some of the effects on ventilatory function in each of the latter 2 studies.

Diminished respiratory function in childhood may well have long-term consequences. In an ongoing study of the natural history of chronic bronchitis and emphysema, Fletcher and colleagues (1976) found that "in middle age the extent to which the obstructive disorder has already developed can be used to predict future disability and mortality." Prospective studies of children with diminished ventilatory function, similar to that of Fletcher *et al.* (1976) on middle-aged London working men, have not yet been reported. Thus, the evidence has not yet been accumulated to estimate the risk for subsequent respiratory disease in children with diminished ventilatory function.

In and of itself, slightly diminished lung function may not be important, but when other respiratory challenges such as recurrent infections, cigarette smoking, air pollution, and occupational exposures are added, respiratory health may be seriously compromised. Burrows *et al.* (1977) recently observed close relationships between a history of childhood respiratory disorders and prevalence of symptoms, obstructive airway diseases, and ventilatory impairment in adults. These investigators noted that even young adults with relatively mild ventilatory impairment and a history of pediatric respiratory illness show a steeper declining slope in function with age and with cigarette use than adults without impairment or history of illness. The fact that air pollution exposure increases the risk in childhood of both diminished lung function and of acute respiratory illness also suggests an increased risk for subsequent development of obstructive lung disease in adulthood (Reid, 1969). Long-term prospective studies, beginning in childhood, are clearly required to provide definitive evidence for these possible relationships.

The observations of Toyama (1964) and Watanabe (1965) cited in table 9, on improvement in peak expiratory flow rates in children living in more polluted communities when air pollution concentrations decreased, is significant in suggesting the reversibility of the air pollution effect on ventilatory function, at least in childhood. More serial studies of this nature are desirable to confirm these findings. Reversibility of the effect of air pollution in adults is also shown in the filtered chamber studies of Balchum (1973) and Motley *et al.* (1959); these investigators demonstrated improved lung function in Los Angeles subjects with obstructive airway disease after subjects spent 40 or more hours in a clean filtered room. This beneficial effect, attributed to removal of photochemical oxidant pollution from the environment, cannot be directly extrapolated to other types of air pollution. However, much of the available data from prospective studies points to the conclusion that removal of offensive agents, such as smoking, air pollution, or occupational irritants, slows the development of the obstructive airway effect, and in some cases results in a return to nearly normal functional status, particularly if the agents are removed relatively early.

Experimental Studies of Ventilatory Function in Exposed Humans

Although experimental studies of human response to air pollutants have also focused on measurements of ventilatory function, such investigations deserve separate consideration from the previous reports because they provide valuable information on human responses to individual pollutants and on interactions between pollutants. Most of the reported experimental human exposures have investigated mechanical properties of the lung in response to 15-min to 6-hour exposures to ozone, NO_2, or SO_2. Results of these

TABLE 9

AIR POLLUTION AND VENTILATORY FUNCTION

Study	*Characteristics*	*Findings*
Bates (1962, 1966)	Sequential measurements of lung function in veterans from 4 Canadian cities	Veterans in least polluted city had best lung function which decreased less during the period of observation than for veterans from the other 3 cities.
Prindle *et al.* (1963)	Comparison of respiratory disease and lung function in residents of Seward and New Florence, Pa	Increased airway resistance in inhabitants of more polluted community. Differences in occupation, smoking, and socioeconomic level could account for these differences.
Toyama (1964), Watanabe (1965)	Peak flow rates in Japanese school children residing in Kawasaki and Osaka	Lower peak flow rates in children from more polluted communities. Improved peak flow rates when air pollution levels decreased.
Anderson and Larsen (1966)	Peak flow rates and school absence rates in children 6–7 years of age from 3 towns in British Columbia	Significant decrease in peak flow rates in 2 towns affected by Kraft pulp mill emissions. No effect on school absences. Ethnic differences were not studied.
Lunn *et al.* (1967, 1970)	Ventilatory function in 5- and 11-year-old children living in 4 districts of Sheffield, England, 1963–1965, and re-examined 4 years later	Lower than predicted ventilatory function only in the most polluted community. Re-examination 4 years later failed to show this effect, but air quality had improved in the interval.
Holland *et al.* (1969a, 1969b)	Peak flow rates in more than 10,000 school children residing in 4 areas of northwest London, 1964/1965. Greatest differences among areas were found in degrees of air pollution	Independent and additive effects of social class, family size, history of respiratory illness, and community air pollution on peak flow rates. Area of residence (as index of air pollution exposure) had greatest influence on peak flow rates.
Biersteker and van Leeuwen (1970, 1971)	Peak flow rates in 935 school children living in 2 districts of Rotterdam, one relatively affluent and having good air quality (40 μg of smoke per m^3 and 120 μg of SO_2 per m^3) and the other less affluent, and having 50% higher concentrations of smoke and SO_2	No significant area differences in peak flow, adjusted for height and weight. Significantly more childhood bronchitis in more polluted district, but differences were judged to be due to poor living conditions.
Ferris (1970)	Pulmonary function and school absences in 6-to-8-year-old children living in Berlin, N. H., 1966–67	No consistent effect of air pollution on total or respiratory absence rates. Peak flow rates were lowest in children from more polluted neighborhood, but effect was partially attributed to lower social class and air pollution.
Shy *et al.* (1973a)	Ventilatory function in elementary school children from communities selected to represent an air pollution gradient in Cincinnati, New York City, and Chattanooga, 1967–1971	Ventilatory function adjusted for age, sex, height, and social class was lower in white but not in black children living in more polluted areas of Cincinnati, in white children in Chattanooga, and in white children 9–13 years of age but not 5–8 years of age in New York. Lack of differences in New York City children 5–8 years of age may be due to improved air quality, although conclusions are speculative. Differences were generally small and not always consistent.
Speizer and Ferris (1973b)	Ventilatory function in Boston central city and suburban traffic policemen	No difference in ventilatory function measurements between the 2 groups.
Mostardi and Leonard (1974)	Ventilatory function in high school students from an industrialized and a rural community in Ohio, 1970 and 1973	Diminished vital capacity, forced expiratory volume in 1 sec and maximal aerobic capacity on exercise in the industrial community. Effect of cigarette smoking was not analyzed.
Chapman *et al.* (1976)	Ventilatory function in nearly 8,000 elementary school children in Birmingham, Ala. and Charlotte,	In 8 age, sex, race specific subgroups, ventilatory function adjusted for age and height was consistently lowest in

TABLE 9 *(Continued)*

Study	*Characteristics*	*Findings*
	N. C., 1971-1972	the more polluted city. Intercity difference in ventilatory function by season paralleled area differences by season in degrees of particulate pollution.
Lawther *et al.* (1974a, b, c)	Day-to-day changes in ventilatory function of a small group of normal adult subjects and 2 bronchitics in London	After multiple regression analysis to remove effects of time trend, SO_2 concentrations explained the largest proportion of variance in peak flow rates. Clearest associations were shown after exercise in periods of heavy pollution. In some subjects it was difficult to detect any consistent effects of pollution.
Waller *et al.* (1974)	Ventilatory function and respiratory symptom prevalence among 18-year-olds born in London just before and after the smog episode of 1952	No differences were found between the 2 groups. Both were exposed to high degrees of pollution during the 1950s. History of lower respiratory illness in childhood had major influence on current symptoms and ventilatory function.
Motley *et al.* (1959)	Lung function tests in 66 adult volunteers, 47 with obstructive airway disease, before and during stays in filtered rooms in Los Angeles	Improvement in lung function, particularly residual volume, observed in subjects with obstructive airway disease after 40 or more hours in the filtered rooms. No changes in normal subjects.
Rokaw and Massey (1962)	Effect of environmental variables on pulmonary function of 31 adult patients in a chronic disease hospital in Los Angeles during a period of 18 months	No consistent relationship between oxidant concentrations and pulmonary function in the patient group.
Schoettlin (1962)	Weekly pulmonary function tests and responses to a symptom questionnaire in armed forces veterans living in a chronic disease unit in Los Angeles	Air pollution measurements consistently explained more variation in symptom frequency and pulmonary function in a diseased group than in a nondiseased control group.
McMillan *et al.* (1969)	Peak flow rates in 2 groups of Los Angeles school children selected from 2 schools representing an area gradient for oxidants, measured twice monthly for 11 months, 1967/1968	Persistently higher peak flow rates in children from more polluted community. No statistical adjustment of results for differences in ethnic factors or respiratory symptom rates.
Cohen *et al.* (1972a)	Ventilatory function and chronic respiratory symptoms in adult nonsmoking Seventh Day Adventists residing in Los Angeles and San Diego	No apparent effect of area differences in photochemical air pollution on ventilatory function of the nonsmoking groups.
Balchum (1973)	Daily pulmonary function measurements in 15 adult patients exposed to ambient Los Angeles air for 1 week and clean filtered air for a second week	During the week of filtered air, an increase in blood PO_2 and a decrease in airway resistance in both smokers and nonsmokers. Results suggest a beneficial effect of improved air quality in a community with photochemical air pollution.
Lebowitz *et al.* (1974)	Ventilatory function in exercising children, adolescents, and adults in Tucson, Ariz., 1972, with comparisons of indoor and outdoor exposures	Exercise outdoors on hot days with heavy pollution resulted in greater decrements in ventilatory function after exercise in school children than on days of lighter pollution and temperature. No significant effect of exercise (or food intake) in the indoor exercise group. Adolescents who completed a 20-mile walk showed a significant postexercise decrease in ventilatory function. Oxidants, particulates, and temperature appeared to affect the results.
Kagawa and Toyama (1975) Kagawa *et al.* (1976)	Ventilatory function measured weekly for 29 weeks, June-December 1972 in 21 Tokyo school children, and again from November 1972-March 1973	Ventilatory function adjusted for temperature significantly correlated with ozone in some of the children.
Linn *et al.* (1976)	Ventilatory function and respiratory symptoms in office-workers in Los Angeles and San Francisco, summer 1973	No apparent difference in function between populations was attributable to photochemical air pollution.

experiments are particularly useful in determining the precise concentrations of a specific pollutant, usually in isolation or in combination with 1 other pollutant, at which airways of healthy adults can be affected. A no-effect concentration demonstrated by experimental exposure of healthy young adults to individual gases is probably not predictive of no-effect exposures for chronically ill and other sensitive persons of all ages exposed to mixtures of pollutants and in whom biologic responses to pollution are modified by intervening factors. Nevertheless, experimental studies of healthy human volunteers are invaluable in identifying physiologic responses to precisely known pollutant concentrations and in establishing dose-response relationships applicable to a segment of the human population. However, the mechanical properties of the lung may not be especially sensitive indicators of effects nor directly related to other population responses to air pollution exposure such as excess mortality and increased risk of respiratory disease. Further, experimental studies may not adequately represent the real atmosphere with its complex and dynamic mixture of air pollutants (Section 3).

In several of the published reports of experimental human exposures to SO_2 there was wide variability among individual subjects in the reactions observed. In particular, some apparently normal persons in the studies of Frank and associates (1964), Nadel and co-workers (1965), and Lawther and associates (1970, 1974a, 1974b, 1974c) showed marked reactivity at the low range of doses. With greater attention to the hyperreactive state, it is possible that lower concentrations of pollutants will be shown to impair lung function in some persons consistently (Orehek *et al.*, 1976; discussed subsequently).

Increased airway resistance has been demonstrated in persons experimentally exposed to SO_2 at concentrations of 14,300 µg per m^3 (5 ppm) or more (Frank *et al.*, 1962, 1964; Nadel *et al.*, 1965; Weir and Bromberg, 1972, 1973). An SO_2 concentration of 2,100 µg per m^3 (0.75 ppm) may diminish expiratory flow rates in an occasional sensitive person during intermittent light exercise (Bates and Hazucha, 1973). The effect of SO_2 on airways is rapidly reversible, and inhalation through the nose rather than the mouth produces a smaller response presumably due to increased absorption of SO_2 in the nasal passages. The physical state of SO_2, i.e., a gas or aerosol droplet, greatly affects the deposition of the pollutant and hence its impact on the respiratory system. Nasal flow resistance may increase at SO_2 concentrations of 2,800 µg per m^3 (1 ppm) for 1 to 3 hours (Andersen *et al.*, 1974). Ventilatory function in average healthy subjects does not appear to be altered by exposures to SO_2 concentrations of less than 2,100 µg per m^3 (0.75 ppm).

Attempts to demonstrate a combined effect of SO_2 with sodium chloride aerosol in humans have failed to show synergism (Burton *et al.*, 1969; Frank *et al.*, 1964). Increased relative humidity of the aerosol appears to be an important factor in producing airway effects (McJilton *et al.*, 1973). Studies of chemically inert dusts and powders alone at doses of 5 to 10 mg have demonstrated increased airway resistance with particles less than 0.5 µm in diameter (DuBois and Dautrebande, 1958; Lovejoy *et al.*, 1961). Norris and Bishop (1966) exposed healthy subjects and patients with lung disease to a calcium carbonate aerosol ranging from 0.2 to 5.0 µm in diameter, at concentrations of 40,000 to 120,000 particles per ml, and observed uneven distribution of ventilation and impaired gas exchange; healthy subjects required longer exposure to respond, whereas recovery was delayed in asthmatic subjects. Sulfuric acid aerosols in the range of 350 to 500 µg per m^3, with a mean diameter of 1 µm, caused an increase in breathing rate and decreased flow rates (Amdur *et al.*, 1952).

Experimental exposures of human subjects to ozone (O_3)-reveal effects on ventilatory function at concentrations that are at times reached in the ambient atmosphere especially in areas characterized by oxidant type pollution. Exposures to 1,000 to 2,000 µg of O_3 per m^3 (0.5 to 1.0 ppm) for 1 to 2 hours produces changes in airway resistance, expiratory flow, vital capacity, and diffusing capacity (Young *et al.*, 1964; Goldsmith and Nadel, 1967).

Bates and Hazucha (1973), Hazucha and associates (1973), and Hackney and co-workers (1975a, 1975b, 1975c, 1977a), using a standarized 2-hour exposure protocol consisting of 15 min of light exercise alternating with 15 min of rest, have demonstrated decreased forced expiratory performance with O_3 concentrations of as little as 500 to 740 µg per m^3 (0.25 to 0.37 ppm), with greater responses in Canadian subjects, as compared to Los Angeles subjects exposed to the same regimen (Hackney *et al.*, 1977a).

These results support the hypothesis for differences in reactivity between these 2 groups, possibly explained by some degree of adaptation or self-selection in Los Angeles subjects who were frequently exposed to similar concentrations of O_3 in the ambient air. Because of the limited number of subjects in this study, a second study using a larger and more closely matched group was done. Newly arrived nonresidents were compared with Los Angeles area subjects. Los Angeles subjects were less reactive than the matched group of nonresidents to a standardized ozone exposure (Hackney *et al.*, 1976). In a more direct test of whether adaptation to O_3 occurs in humans, 6 subjects were exposed to ozone, approximately 2 hours per day, for 4 days in a row. In general, changes in lung function and in the occurrence of symptoms were detected on the first and second days of exposure, but were absent on the fourth day (Hackney *et al.*, 1977b).

Bates and Hazucha (1973) also noted an enhancement of the effect on expiratory flow rates from exposure to ozone at 740 µg per m^3 (0.37 ppm) by the addition of SO_2 at 1,000 µg per m^3 (0.37 ppm), at which concentration SO_2 itself had no effect. Maximal expiratory flow rates were diminished by 15 per cent after 2-hour exposure to 740 µg of O_3 per m^3 whereas exposure to the combination of O_3 and SO_2 resulted in a 55 per cent decrease in expiratory flow. To investigate further the possible interactive effects of SO_2 and O_3 and the mechanisms for the interaction, Bell and associates (1977), in a cooperative study with Bates and Hazucha, exposed Los Angeles subjects to 740 µg of O_3 per m^3 (0.37 ppm) and 1,000 µg of SO_2 per m^3. (0.37 ppm) and observed changes that suggested less severe acute toxicity to the combined pollutants than had been previously reported. Responses of Canadian and Los Angeles subjects were also compared in this investigation. Canadian subjects showed less severe acute toxic responses than they had in the previous study (Bates and Hazucha, 1973) to the combined exposures, and only slightly more response than with O_3 alone. Sulfur-containing aerosols formed by chemical reactions within the chamber air may have contributed to the O_3 plus SO_2 responses in the Canadian study. Adaptation of Los Angeles residents to ambient O_3 may also contribute to response variation (Bell *et al.*, 1977).

DeLucia and Adams (1977) observed the onset of subjective symptoms and some signs of toxicity in 6 subjects exposed for 1 hour to 300 and 600 µg of O_3 per m^3 (0.15 and 0.30 ppm) when subjects were exercised at 65 per cent of maximal oxygen uptake, whereas little effect was observed in the same subjects exposed to 300 µg of O_3 per m^3 (0.15 ppm) while exercising at 25 per cent of maximal oxygen uptake. Two of the "sensitive" subjects manifested changes in forced expiratory volume, respiratory frequency and tidal volume at 300 µg of O_3 per m^3 (0.15 ppm) and 65 per cent of maximal oxygen uptake. These results show the magnification of O_3 effects at a given concentration by increasing the effective dose with greater degrees of exercise.

The effects of experimental exposure to NO_2 have been investigated by von Nieding and associates (1973) and Abe (1967) who found significant increases in airway resistance of healthy subjects after 1- to 15-min exposures to NO_2 at concentrations of 3,000 to 4,700 µg per m^3 (1.6 to 2.5 ppm). The effect was prevented by administration of an antihistamine, but not by a sympathomimetic bronchodilator (von Nieding and Krekeler, 1972), which suggests that NO_2 acts on airways by release of histamine rather than by a parasympathetic reflex mechanism as in the case of SO_2.

Orehek and co-workers (1976) evaluated the interaction between expsosures to NO_2 and bronchoconstricting agents in subjects with asthma. NO_2 concentrations of 210 µg per m^3 (0.11 ppm) alone caused a significant increase in airway resistance in 3 of 20 subjects. However, the same NO_2 concentration significantly increased the bronchial sensitivity to the bronchoconstricting agent, carbachol, in 13 of the 20 subjects, when responses to carbachol were compared for NO_2 and unpolluted air. In the remaining 7 subjects, NO_2 neither modified the initial airway resistance nor affected the bronchoconstrictor effect of carbachol. It is not known whether similar ambient concentrations of NO_2 will enhance the effect of naturally occurring bronchoconstricting agents.

The importance of studies of human experimental exposure lies in the ability to quantify the dose at which airway responses occur, to measure responses in hyperreactive persons, to study interactions between pollutants, and to identify mechanisms of response. Limitations of these studies with respect to protection of the general population have been discussed.

Several studies of laboratory animals bear on the effects of various air pollutants on the mechanical and other properties of the lung. These studies are extensively reviewed elsewhere (e.g., Amdur, 1969; Mueller and Hitchcock, 1969; National Research Council, 1977d, 1977e) and are selectively cited in Section 3. The animal studies contribute considerable additional detail on mechanisms of response and dose-response relationships.

Air Pollution and Cancer of the Lung

Although the evidence that cigarette smoking is the major factor in the causation of lung cancer is well recognized, exposures to other environmental pollutants appear to contribute to variations in the distribution of this disease in populations. Occupational exposures to ionizing radiation among uranium miners, and to asbestos, arsenic, chromates, nickel, and coke oven fumes are well established as risk factors for lung cancer (Cole and Goldman, 1975). Many aspects of the occupational health risk are unresolved, such as whether nonsmoking workers actually are at increased risk when compared with the general population of nonsmokers.

There is no general agreement that urban air pollutants contribute to the development of lung cancer. The overwhelming contribution of cigarette smoking makes comparisons of lung cancer rates in areas of heavy and light pollution meaningless unless adjustments are made for smoking habits in each population. An international study group met in 1977 to evaluate the evidence concerning an association of air pollution and cancer. In its report (Karolinska Institute, 1977), this group concluded that, whereas cigarette smoking is the predominant cause of lung cancer and an important component of urban-rural differences, "Combustion products of fossil fuels in ambient air, probably acting together with cigarette smoke, have been responsible for cases of lung cancer in large urban areas, the numbers produced being of the order of 5-10 cases per 100,000 males per year." The study group recognized that the evidence for an air pollution effect was not consistent under all circumstances, and that such factors as indoor air pollution from cooking, heating, aerosol sprays, and sidestream smoke need to be evaluated in future studies.

The hypothesis that air pollution may be a factor in human lung cancer derives from 3 types of studies: (*1*) comparison of lung cancer rates in immigrants from one country to another with the rates of native-born nonimmigrants in both countries (e.g., Eastcott, 1956; Dean, 1964; Reid *et al.*, 1966), (*2*) investigations of urban-rural differences in lung cancer risk (e.g., Mancuso *et al.*, 1955; Hoffman and Gilliam, 1954; Buell, 1967; Hammond and Horn, 1958; Haenszel *et al.*, 1962 and 1964; Hammond, 1972), and (*3*) quantitative or qualitative differences in air pollution by area and associated lung cancer rates (e.g., Stocks, 1959; Winkelstein *et al.*, 1962; Menck, 1974; Carnow and Meier, 1973; Hitosugi, 1968; Hammond, 1972).

The pattern of lung cancer in immigrants from one country to another suggests a lasting effect of early environment on lung cancer risk. The immigrant appears to take on a risk intermediate to that of his country of birth and country of adoption, a risk that cannot be explained by differences in smoking habits. Urban-rural lung cancer ratios in men and women are almost as consistent (with greater risk in urban residents), although not as strong as ratios for smokers versus nonsmokers. The urban excess persists when lung cancer rates are analyzed specifically for smoking habits. Lung cancer rates of communities distributed by population size or population density exhibit a dose-response relationship as striking as that for smoking intensity, although of lesser magnitude, but after adjusting for smoking distributions, some of the effect of population size or density disappears. Differences in diagnostic practices or access to medical care have been evaluated and have failed to explain the urban excess.

Benzo(a)pyrene (BaP) is the most commonly employed index for atmospheric carcinogens, particularly for the class of polycyclic hydrocarbons. Few investigators have attempted to correlate BaP concentrations with lung cancer rates in different communities, largely because few BaP measurements have been made in a sufficient number of places. Carnow and Meier (1973) aggregated BaP data from a few sites in each state into a single air pollution estimate for the entire state. This estimated exposure was entered into a multiple-regression analysis with state-wide sales of cigarettes, in an effort to account for state differences in lung cancer rates. The findings suggested a linear relationship between BaP and lung cancer rates, but were unconvincing primarily because the estimates for BaP exposure were themselves implausible.

Menck and associates (1974) found greater than average lung cancer rates for men but not for women in a contiguous group of heavily industrialized census tracts in Los Angeles, and reported an association with a very small number of BaP measurements in air and soil. However, occupational exposures or area differences in smoking habits may well account for the observed gradient. Hitosugi (1968) obtained data on smoking habits of lung cancer patients and a representative sample of the population from 3 areas of pollution near Osaka, Japan. Death rates among smokers increased slightly with increased pollution, as indexed by combining measurements of dust fall, SO_2, particulates, trace elements, and polycyclic hydrocarbons. Rates among nonsmokers were unrelated to pollution differences. Selikoff *et al.* (1968) suggested considerable enhancement of the risk of lung cancer from smoking among asbestos workers. Similar interaction between smoking and occupational exposures have been noted for uranium miners (Archer and Wagoner, 1973). There is no good evidence that carcinogens in the air have similar modifying (promoting) effects with smoking nor that air pollutants are co-carcinogens.

Higgins (1974) examined trends in lung cancer mortality in England and Wales from 1950 to 1970, to test the hypothesis that the greater decrease in particulate pollution in London would result in a corresponding decrease in lung cancer mortality in that area than in other parts of Britain. Although the results were somewhat equivocal, a greater decline in the age-specific death rates in men less than 55 years of age occurred during this period in London, although it is not clear that changing patterns of smoking habits might not have also occurred.

On the basis of the evidence gathered thus far, the suspicion that air pollution leads to lung cancer remains neither proved nor disproved. The overwhelming influence of cigarette smoking, the contribution of occupational exposures, the scarcity of good measurements of potential atmospheric carcinogens, and the long lag period between first exposure and manifestation of cancer, all contribute to the difficulty of obtaining evidence for a relationship between air pollution and lung cancer.

Air Pollution and Heart Disease

In 1969, the U.S. death rate from diseases of the heart was 366 per 100,000 persons, easily surpassing the death rates from all other causes (U.S. DHEW, 1974). Of the known environmental risk factors that contribute to heart disease, cigarettes, diet, lack of exercise, high blood pressure, and increased serum lipid concentrations have received the most attention. However, evidence exists that air pollution, particularly CO, also increases this risk. Cohen and associates (1969) reported a greater case fatality rate among patients admitted to Los Angeles hospitals during periods of relatively increased carbon monoxide pollution, and Hexter and Goldsmith (1971) found a significant association between community CO concentrations and daily mortality in Los Angeles County, after adjusting for variations associated with season and maximal temperature. Although there are many uncertainties in these findings, their significance is considerably enhanced by studies of persons with angina pectoris exposed to CO on freeways (Aronow *et al.*, 1972) or experimentally (Aronow and Isbell, 1973; Anderson *et al.*, 1973). These latter investigations show that persons with angina experience chest pain significantly earlier during exercise when carboxyhemoglobin concentrations reach 2.5 to 3.0 per cent. CO has also been shown to have predictable effects on maximal oxygen consumption in young men undergoing strenuous exercise (Horvath, 1973; Ekblom and Huot, 1972). The ultimate effect of CO-induced impairment of the oxygen transport system is a tissue deficit of oxygen, which in persons with coronary heart disease, represents a serious additional health risk.

A further possible contribution of CO to coronary heart disease is suggested by studies of animals, in which CO enhanced the effect of increased serum cholesterol on the development of arteriosclerosis in cholesterol-fed rabbits (Astrup *et al.*, 1967).

Several other reports suggest relationships between exposure to O_3 and damage to myocardial fibers (Brinkman *et al.*, 1974), between exposure to SO_2 and cardiovascular deaths (Carnow, 1973), and between sulfate concentrations and exacerbation of disease in elderly persons with heart disease (Goldberg *et al.*, 1974). Large concentrations of cadmium in the air have been correlated with death rates due to cardiovascular disease (Carroll, 1966). In general, these latter reports are not supported by a substantive body of toxicologic or epidemiologic evidence, and the association of heart disease with pollutants other than CO remains uncertain.

Air Pollution, Sensory Irritation, Central Nervous System Function, and Human Performance

To many persons, the odor of some airborne substances and irritation to the eyes, nose, and throat are the most common and annoying aspects of air pollution. Perception of these effects is very real, but quantifying them is very difficult (Henkin, 1976). Investigations are hampered by individual variability and absence of objective measurements of sensory perception and by the lack of identifiable tissue changes associated with perception. Nevertheless, these are the problems people complain of most, and their existence is very real.

Except for hydrogen sulfide, most odorous materials are difficult to measure at concentrations that are perceived as objectionable. Accordingly, odor annoyance survey methods (Karolinska Institute, 1970) are appropriate ways of monitoring for odor and estimating the severity of impact. Deane and associates (1977) applied these methods to studies done near pulp mills and refineries. A question raised by this work is whether odorants may not be capable of producing or aggravating respiratory symptoms. Hydrogen sulfide is a common and offensively odorous material, readily perceived by its rotten egg odor. It emanates from kraft paper mills, industrial waste disposal ponds, sewage treatment plants, tanneries, coke oven plants, and geothermal wells. At great concentrations (more than 1 ppm), hydrogen sulfide may impair the sense of smell and produce unconsciousness or death.

Aldehydes produced by incomplete combustion of fossil fuels are irritating to the skin and eyes; formaldehyde is one of the more common aldehydes that irritate the eyes, nose, and other portions of the respiratory tract (Fassett, 1963). Ammonia, which is also produced from fossil fuel combustion, is a strong respiratory irritant.

O_3, the major component of photochemical smog, is directly irritating to the pharynx and trachea, causing a burning sensation in the upper part of the chest, particularly during vigorous exercise. These sensations are commonly reported in Los Angeles on smoggy days. A number of Japanese investigators (e.g., Shimizu, 1975; Makino and Mizoguchi, 1975) have described eye irritation, chest discomfort, headache, and various other symptoms in school children playing outdoors on "smog alert" days in various cities in Japan. Large numbers of children appeared to be affected. These effects were probably produced by combinations of pollutants that occurred at increased concentrations during hours of peak oxidant concentrations. Experience in the United States suggests that the concentrations of O_3 were too small for the effects to be attributed to O_3 alone.

CO can alter human performance as well as cardiac function. At small concentrations, effects on various measures of performance, such as time interval discrimination and ability to concentrate are small and variable, but at carboxyhemoglobin concentrations of 2 to 5 per cent, decrements in vigilance tasks (Horvath *et al.*, 1971; Groll-Knapp *et al.*, 1972; Fodor and Winneke, 1972), in time discrimination (Beard and Wertheim, 1967), and in visual threshold (Halperin *et al.*, 1959) have been demonstrated in experimentally exposed subjects. Some studies of subjects having carboxyhemoglobin concentrations of as much as 15 per cent have shown little effect on automobile driving performance (Ray and Rockwell, 1970), and other measures of complex intellectual function, such as the ability to perform arithmetic tasks, have not been affected by carboxyhemoglobin concentrations of as much as 20 per cent (Stewart *et al.*, 1970; Mikuika *et al.*, 1970). Apparently, the effect of CO can be overcome by sustained interest in the task, although when subjects are required to perform tedious and monotonous tasks, as in the case of vigilance testing, CO can impair performance.

Inhalation of significant amounts of airborne lead can cause neurologic disturbances and even adverse effects on the central nervous system. However, general community pollution with airborne lead will not directly produce this degree of toxicity. Children living near a lead smelter were shown to have altered nerve conduction velocities (Landrigan, 1976) at moderately increased blood lead concentrations of 40 to 68 μg per 100 ml, but there are no data concerning chronic effects on the central nervous system at these blood lead concentrations.

From the previous discussion, it is apparent that air pollutants can have important effects on sensory organs and on human performance. Some of these effects are easily perceived; others are subtle and difficult to demonstrate. The long-term health implications of this category of effects are laregly unknown.

Air Pollution and Effects from Persistent Metals and Other Materials

Certain trace metals, such as lead and cadmium, and various synthetic chlorinated hydrocarbons, such as DDT and polychlorinated biphenyls, accumulate in the body. Tissue concentrations or residues of these substances tend to increase with continued exposure and may not be predictable from serum or red blood cell concentrations. Human populations are exposed to these materials through several environmental media, including food, water, and air. For some substances such as chlorinated hydrocarbons, food or water represents the major avenue for human exposure. In the case of lead, the lungs as well as the gastrointestinal tract are important routes of entry into the body. Trace metals absorbed into the body are often excreted in amounts proportional to tissue concentrations. Chronic excesses of trace metals in tissues are believed to have toxic effects (Lee, 1972b), but the effects of small, persistent concentrations are not generally known. Under normal conditions, airborne lead makes a substantial contribution to the total blood lead and body burden (Kopple *et al.*, 1976), but does not cause overt poisoning. The importance of airborne lead lies in the fact that, although it does not cause poisoning, it contributes to an increased "background" concentration of lead in the body and thereby increases the risk of harm when other sources of lead (such as lead-based paint and lead in pottery) are added to the exposure complex. There is also concern over the fallout of lead from automotive exhaust onto soil and street surfaces from which it can be ingested in significant concentrations by infants and young children. Children living near busy roadways (Daines *et al.*, 1970) or near a lead smelter (Landrigan *et al.*, 1976; Baker *et al.*, 1977), were shown to have increased blood lead concentrations, and it is possible that inhalation of airborne lead and ingestion of lead fallout together accounted for these excess blood lead concentrations.

Neighborhoods in the vicinity of smelters, processing plants, or construction projects have been shown to be important sources of nonoccupational human exposure to asbestos (Selikoff and co-workers, 1972), arsenic (Blot and Fraumeni, 1975; Baker and associates, 1977), beryllium (Sussman and co-workers, 1959) and other trace metals (Baker and associates, 1977). Common to these substances is the fact that they also accumulate in the body and can lead to long-delayed effects such as pulmonary fibrosis and lung cancer.

The accumulation of substances such as nonessential trace metals and synthetic chlorinated hydrocarbons in the body is a cause for concern. In the case of the synthetic hydrocarbons, we know little about the long-term health consequences of increased tissue concentrations, but there is suspicion, based on animal studies (Innes and associates, 1969) that some of these compounds are carcinogenic. Considerably more is known about the toxic effects of increased tissue concentrations of lead, cadmium, and arsenic (Lee, 1972). Although air pollution is not the major source of toxicity from these compounds, it is an important contributor to tissue concentrations and may increase the risk of toxic effects when other environmental exposures are added. Perhaps more so than for the ubiquitous air pollutants, it is necessary to use animal toxicity data for trace metals in establishing guidelines for the protection of public health.

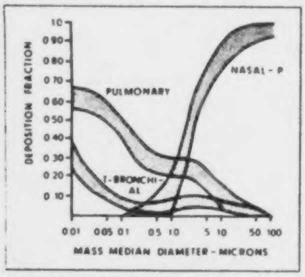


Fig. 3. Deposition in various portions of the lung and respiratory tract for various particle populations. Each of the shaded areas (envelopes) indicates the variability of deposition for a given mass median aerodynamic diameter in each compartment when the standard geometric deviation (σg) varies from 1.2 to 4.5 μm, and the tidal volume is 1,450 ml: nasopharyngeal (Nasal-P), tracheobronchial (T-Bronchial), and alveolar (Pulmonary). Source: Task Group on Lung Dynamics, 1966.

TABLE 10

REMOVAL AND CLEARANCE OF PARTICLES FROM THE RESPIRATORY SYSTEM

	Defense Mechanisms	
Site of Action	*Removal of particles from the airstream (particle deposition)*	*Clearance of deposited particles*
Upper respiratory tract (nasopharynx)	Impaction on fine hairs and in narrow and tortuous passages of the nose	Nose blowing Sneezing, coughing Mucociliary action Swallowing
Tracheobronchial tree	Impaction Sedimentation Diffusion	Coughing Mucociliary action Bronchial blood flow
Alveolar zone	Sedimentation Diffusion	Phagocytosis by macrophages Transepithelial transport to lymph and blood

3. The Action of Air Pollution on the Respiratory System

Normal Defense of the Respiratory System against External Challenges

Particles. The respiratory system is well endowed with mechanisms to remove and clear particles. Although a person breathes 10,000 to 20,000 liters of air per day, each liter of which may contain several million suspended particles, the air that reaches the terminal respiratory unit with each breath is remarkably cleansed. This cleansing action is brought about by 2 basic respiratory defense mechanisms, as shown in table 10: deposition of airborne particles on the epithelium of more proximal portions of the respiratory tract, especially the nose, and ciliary and alveolar macrophage clearance of particles deposited on the lining surface (Murray, 1976; Comroe, 1974). In addition to these physical defenses, there is an immunologic defense system with a cellular and immunoglobulin component that responds to various inhaled antigens.

Depending on the aerodynamic size of inhaled particles and the velocity of air movement through the respiratory passages, particles will be deposited in 1 of 3 respiratory zones: the nasopharyngeal (during nasal breathing), the tracheobronchial, or the alveolar zone. The hypothetical relationship between particle size and deposition in each zone is illustrated in figure 3 (Task Group on Lung Dynamics, 1966). Larger particles are deposited primarily in the nasopharynx; smaller particles with a mass median diameter of 1 μm or less are deposited primarily in the tracheobronchial tree and alveolar zone. As listed in table 10, the mechanisms for the deposition and clearance of particles differ at each site. Impaction of particles occurs when inhaled air changes direction as it follows the tortuous pathways through the nose and pharynx; the momentum of larger particles tends to keep them moving in a straight line, forcing them to impact on airway walls as the direction of airflow changes. Deeper in the respiratory tract, where airflow is considerably slower, sedimentation is important for particle deposition. The smallest, submicronic particles are in Brownian motion and may randomly contact terminal bronchiolar and alveolar surfaces by diffusion. The likelihood that diffusion will result in contact with the tissue surface increases with the dimension of the airway or alveolus.

Once particles are deposited on airway surfaces, they may be removed by several means, as listed in table 10. Nose blowing, sneezing, coughing, and swallowing eliminate particles from the upper respiratory passages, trachea and more central bronchi, whereas mucociliary transport, transepithelial passage into lymph or blood, and engulfment by alveolar macrophages are effective clearance mechanisms in the lower respiratory tract. However, passage of particles into lymph and blood can be deleterious, resulting either in local entrapment and chronic tissue reactions or transport to distant organs in which adverse effects can take place. Droplet aerosols may absorb chemicals and gases from the environment and carry them more deeply into the lung than would otherwise occur.

Gases. Solubility and chemical reactivity of gases, together with rate and depth of inspiration, determine the site and fractional uptake of gases within the respiratory tract (National Research Council, 1977e). At ambient concentrations, soluble gases will largely be absorbed by the walls of the upper air passages, where they may be buffered, detoxified by biochemical reactions, diffused into systemic circulation or exert a pathologic effect. Respiratory reflexes influence the distribution of inhaled gases; these reflexes involve neuroreceptors located in the nose, larynx, tracheobronchial tree, and lung parenchyma. Stimulation of different receptors provokes sneezing, coughing, laryngeal closure, bronchoconstriction, and/or rapid, shallow breathing. Nonirritant gases such as CO may bypass these defense mechanisms and generally be absorbed into the blood stream. SO_2, which is relatively soluble, tends to be absorbed through the epithelial lining of the nasopharynx. Less soluble gases such as O_3 and NO_2 pass more deeply into the respiratory tract, although their irritant properties will usually stimulate one of the respiratory tract neuroreceptors. Because the alveolar surface is so large, even a gas of low solubility may be extracted in significant amounts on penetration to the alveoli. Residence time in the alveolus may also be a factor in the toxicity of gases. For mouth breathers, some of the previously described defense mechanisms are bypassed.

Health Effects and Ambient Air Quality

National primary air quality standards in the United States and the principal health effects associated with increased concentrations of these pollutants are listed in table 11 (U.S. DHEW, 1969a, 1969b, 1970a, 1970b; U.S. EPA, 1971). Standards for atmospheric sulfates, hydrogen sulfide, and lead have also been adopted in several states. In some urban areas of the United States, standards for some of the pollutants are frequently exceeded. In rural areas, ambient concentrations tend to average one fourth to one half of the national standards. Transformation products of SO_2 such as sulfate-containing particles and photochemical oxidants are known to be transported long distances from their usual urban sources to distant, often rural areas. As a result, concentrations of atmospheric sulfates, for which no national standard has been set, and of photochemical oxidants at or above the standard have been found in places far from major emission sources for these pollutants.

TABLE 11

NATIONAL PRIMARY AIR QUALITY STANDARDS AND PRINCIPAL HEALTH EFFECTS ATTRIBUTED TO INCREASED CONCENTRATIONS OF POLLUTANTS

Pollutant	*Primary Air Quality Concentration*	*Standard Averaging Time*	*Principal Health Effects Attributed to Concentrations Greater than the Standard*
SO_2	80 μg/m^3 (0.03 ppm)	Annual arithmetic mean	Aggravation of chronic obstructive lung disease
	365 μg/m^3 (0.14 ppm)	Maximal 24-hour average	Increased risk of acute and chronic respiratory illness (see tables 5–8)
Total suspended particulates	75 μg/m^3 260 μg/m^3	Annual geometric mean Maximal 24-hour average	Altered lung function in children (table 9)
Photochemical oxidants	160 μg/m^3 (0.08 ppm)	Maximal 1-hour average	Eye irritation Respiratory function impairment
NO_2	100 μg/m^3 (0.05 ppm)	Annual arithmetic mean	Risk of acute and chronic respiratory disease
CO	10 mg/m^3 (9 ppm)	Maximal 8-hour average	Impairment of oxygen transport
	40 mg/m^3 (35 ppm)	Maximal 1-hour average	Aggravation of cardiovascular disease

HAZARDOUS AIR POLLUTANTS CONTROLLED BY NATIONAL EMISSION STANDARDS*

Pollutant	*Principal Health Effects Attributed to Environmental Exposures*	*Emmission Standards*
Asbestos	Malignancies of the lung, pleura, and peritoneum	Hazardous air pollutants are defined as air pollutants to which no ambient standard is applicable. Emission standards are established to minimize emissions of the pollutant from all known process and fugitive emissions sources to the degree attainable with the best available control technology.
Beryllium	Progressive granulomatous disease of the lung	
Mercury	Central nervous system and renal toxicity	
Vinyl Chloride	Angiosarcoma of the liver, possibly other cancers, and possibly effects on human reproduction.	

Definition of abbreviations: SO_2 = sulfur dioxide; NO_2 = nitrogen dioxide, CO = carbon monoxide, ppm = parts per million.

*U.S. Environmental Protection Agency (1973, 1975, and 1976).

Much of the evidence for a relationship between air pollution and adverse effects on human health is based on epidemiologic studies. Although showing that air pollution can contribute to the risk or aggravation of disease in populations, epidemiologists have limited opportunities for specifying which pollutant or which concentrations will produce the earliest risk of disease. It is necessary to derive chemically specific information from the experimental laboratory, involving controlled exposures of humans as well as animals. The importance of controlled experimental human exposures has been discussed previously. Experimental studies on animals can establish the biologic plausibility of an association between specific pollutants and adverse human health, and can elaborate the physiologic and biochemical pathways for these responses. When experimental and epidemiologic evidence converges, the task of determing which concentrations are hazardous to human health can be approached with considerably more scientific rigor than otherwise.

There is ample evidence that all of the known "criteria" pollutants (i.e., those for which national air quality standards exist) produce toxic effects in animals exposed to sufficiently high concentrations. Pathophysiologic as well as anatomic changes have been observed. The range of exposed species is extensive, and the observations are remarkably uniform between species. However, susceptibility to toxic effects of a specific pollutant varies greatly between species. These variations, due in part to genetic and anatomic differences and to diet and behavioral patterns, complicate quantitative extrapolation of animal data to humans.

Major differences in opinion exist within the scientific community as to the appropriate margin of safety to be applied to primary air quality standards and whether current standards provide a large or small margin of safety. Toxic effects have been observed even in apparently healthy laboratory animals exposed to concentrations that are 2- to 10-fold greater than ambient concentrations or are even sometimes reached in the ambient atmosphere. In a specific instance, Morrow (1975) reviewed the animal toxicity data for NO_2 and suggested that the present national standard (100 μg per m^3, or 0.05 ppm) provides only a ten-fold margin for safety. Few experimental data are available for combinations of air pollutants and their effects on animals or humans. In some instances, additive or synergistic effects have been observed, but the relative toxicity can depend on the sequence in which animals are exposed to more than 1 pollutant. When these results are compared with the actual population exposures to a large number of pollutants whose concentrations vary by hour, day, and season, one must conclude that sufficient data are not available to assess the toxicity of actual mixtures of pollutants in the ambient air. Experimental studies involving chemically specific pollutants also tend to use healthy human subjects or animals. It is not readily apparent from these data whether sensitive groups in the human population are at equal or greater risk at the same concentration. Research currently under way is attempting to evaluate responses in persons with compromised health or in animal models of human disease.

The cited limitations of epidemiologic and experimental studies prevent even the most qualified health scientists from rigorously determining whether current standards provide a large or small margin of safety. To make recommendations for the protection of public health, it is necessary for clinicians and other health scientists not only to be conversant with the scientific evidence but to make judgments that bridge the many gaps in this evidence. Inevitably, some of these judgments will be made by persons who require "hard evidence" for the existence of an effect, whereas others will want larger margins of safety in the face of the same deficiencies in knowledge. These differences in opinion and judgment should at least be articulated, to prevent administrators and lawmakers from reaching conclusions from a very limited point of view. Thus, there is need for informed scientists of all persuasions to make judgments and communicate these to decision makers.

The Sulfur Oxide/Particulate Complex

Sulfur oxides and suspended particulate matter are being discussed as a single pollutant complex for several reasons: increased concentrations of both pollutants are usually found together in urban areas; SO_2 itself is transformed in the atmosphere into a particulate aerosol and these aerosols may be more biologically reactive than SO_2. The health effects of this complex of pollutants (SO_2, particulates, and aerosols) for the most part have been studied in populations exposed to the pollutant mixture rather than to individual pollutants in isolation. The sulfur oxide/particulate complex is not a chemically or physically specific mixture, but will vary from place to place in particle size, distribution, and chemical species. The instruments generally used to monitor these pollutants do not specify particle size or chemical species other than SO_2. However, from special studies it is known that most suspended particles range in size from submicronic to 10 µm in diameter, with the numerical majority of particles in the submicronic fraction. The chemical nature of the complex has been less well characterized. A variety of sulfur compounds has been identified and includes sulfuric acid, sulfites, and various metallic, acidic, and ammonium sulfates. Combustion of fossil fuel, which is the principal emission source of the sulfur oxide/particulate complex, yields a variety of chemical compounds including oxides of carbon, iron, aluminum, sulfur, silicon, and phosphorous as the main constituents. In the usual monitoring of air quality, information is obtained only for concentrations of SO_2, total suspended particulates, and occasionally suspended sulfates and nitrates.

SO_2 and particulate sulfate aerosols are not potent toxicants in laboratory animals. Exposure to 28,600 µg of SO_2 per m^3 (10 ppm) for 72 hours is required to produce pulmonary edema, necrosis, and desquamation of the respiratory and olfactory epithelium in mice (Giddens and Fairchild, 1972 [141]). The high solubility of SO_2 in water results in its rapid and extensive removal by the upper airways in humans and animals. The concentration reaching the lower airways particularly with nasal breathing is probably no more than 10 to 20 per cent of the inhaled concentration. Whether this protective uptake mechanism can be saturated at high concentrations is unknown, but is also irrelevant to the evaluation of ambient concentrations.

High concentrations of SO_2 in the range of 572,000 to 1,330,000 µg per m^3 (200 to 500 ppm) produced lesions in dogs (Chakrin and Saunders, 1974; Knight and co-workers, 1973), rats, or hamsters (Asmundsson and associates, 1973; Lamb and Reid, 1968) closely resembling human chronic bronchitis. In some of these experiments damage to central airways was extensive as compared to peripheral respiratory tract effects. Studies of the long-term effects of SO_2 in animals have shown no toxic effects at concentrations within the range of usual ambient conditions. Alarie and co-workers (1970, 1972) observed no changes in lung function tests, lung morphology, or blood chemistries during 78 weeks of uninterrupted exposure to 400 or 2,860 µg of SO_2 per m^3 (0.14 or 1.0 ppm), nor were adverse effects found when fly-ash was added to SO_2 (Alarie and co-workers, 1974). However, continuous exposure to sulfuric-acid aerosols at concentrations of 2,400 to 4,800 µg per m^3 for 78 weeks produced histologic alterations and degraded pulmonary function.

Laboratory animals react to lower concentrations of SO_2 by constriction of large and small airways. Amdur (1969) compared the bronchoconstrictive potency of SO_2, sulfuric acid, and a number of aerosols of sulfate salt. When sulfur was present in the form of sulfuric acid or certain sulfate salts, it induced a greater bronchoconstrictive effect than did the equimolar concentration of SO_2 (Amdur, 1971, 1973). The particle size of the aerosol influenced the magnitude of the bronchoconstriction as estimated by airway resistance. This effect was similar to that produced by histamine aerosols. Incubation of guinea pig lung fragments in various sulfate salt solutions resulted in release of histamine (Charles and Menzel, 1975 [68]). The relative efficacy of different sulfate salts in releasing histamine corresponded well with their efficacy in producing bronchoconstriction *in vivo* in guinea pigs. Previous sensitization and degranulation decreased the volume of lung tissue into which sulfates diffused, suggesting that this tissue volume is associated with histamine storage granules. Histamine release and subsequent bronchoconstriction can be evoked by intratracheal injection of ammonium sulfate in the isolated rat lung (Charles *et al.*, 1977 [69]). Previous treatment with an H-1 antihistamine almost completely blocks the bronchoconstrictive effect *in vitro*. Nadel and associates (1965) were able to block SO_2-induced bronchoconstriction with atropine, indicating a vagal reflex that cannot be detected with isolated lung preparations.

The importance of the chemical composition of sulfate aerosols is underscored by Charles and co-workers (1977b), who showed that removal of sulfate from the airways is a function of the cations present in the aerosol or in the intratracheal solution. The rate of removal of sulfate ions can be greatly increased by some of the cations present in particulate combustion products such as fly-ash. The concentration of metal cations needed to increase sulfate removal is small, being about 0.1 to 1.0 nanomole per lung, an inhaled dose that is possible in areas of heavy pollution. Larson and co-workers (1977) hypothesized that gaseous ammonia released into the human respiratory system from normal metabolic processes can neutralize inhaled acidic aerosols and may alter or mitigate their toxicity. To support their hypothesis, they measured ammonia in the expired air of human subjects and found concentrations in the range of 29 to 520 μg per m^3. These concentrations were calculated to have the potential for converting 84 to 1,500 μg of sulfuric acid per m^3 (concentrations exceeding those commonly found in ambient air) to ammonium sulfate, which is a neutral salt. The authors further suggested that some acidic particles may not be fully neutralized before reaching the lower airways, because of low local concentrations of ammonia.

Experimentally exposed humans also react to pure SO_2 by constriction of the large and small airways. The apparent threshold for this acute response to SO_2 in healthy humans as well as in animals seems high as compared to ambient concentrations (Frank and Speizer, 1965; Amdur, 1971; Alarie *et al.*, 1970, 1972; Alarie and Palmes, 1974). Airway narrowing appears to be a reflex response to SO_2 stimulation of multiple neurosensory receptors in the respiratory tract. In humans, the acute effect of SO_2 under experimental conditions is also increased airway resistance, which will occur in most persons only at very high concentrations (14,300 μg per m^3), although some sensitive persons respond to lower concentrations (2,100 to 5,700 μg per m^3) (Frank *et al.*, 1964; Nadel *et al.*, 1965; Weir and Bromberg, 1973; Bates and Hazucha, 1973). With increased humidity (McJilton *et al.*, 1973) or with combined exposure to O_3 (Bates and Hazucha, 1973; Bell *et al.*, 1977) the effect may occur with smaller doses. In studying the effect in healthy subjects of combined exposure to SO_2 (2.5 ppm) and NO_2 (2.5 ppm) for 10 min, Abe (1967) observed an immediate effect on ventilatory mechanics and flow rates, with recovery followed by a delayed effect 30 min after recovery. The author attributed these observations to the independent action of the 2 pollutants on ventilatory performance, with no evidence of additive or enhanced effects.

From epidemiologic studies of populations exposed to sulfur oxides and particulates (studies reviewed in U.S. DHEW 1969a, 1969b; National Academy of Sciences, 1973 and 1975), there is no question that increased ambient concentrations have been consistently associated in large cities with increased mortality during episodes of air pollution (Section 2). On days of high pollutant concentrations, aggravation of symptoms in subjects with pre-existing heart and lung disease occurs (see Section 2). In more polluted cities, there is evidence for a greater prevalence of chronic respiratory disease in adults (Section 2), an increased incidence of acute respiratory disease and depressed lung function in children (Section 2), and increased illness episodes and illness related absences in adults (Section 2). As discussed in Section 2, environmental factors other than air pollution may contribute to, but cannot fully account for, these adverse effects.

Thus far, only a few epidemiologic studies have reported an association between sulfates and adverse health effects, and these results have tended to be controversial. Instruments presently used for monitoring sulfates do not distinguish between different chemical species of sulfates, some of which are biologically more reactive than others. It is therefore difficult to establish consistent associations between specific concentrations of "sulfates" and adverse health effects.

In summary, the effects of SO_2 and particulate sulfates appear to be mediated through indirect mechanisms. Histamine release and subsequent action on bronchial smooth muscle may be responsible for the bronchoconstriction reported in humans and small animals. The effects of sulfate aerosols may be exacerbated in intact animals by the existence of vagal reflex arcs. Pre-existing disease in humans may be responsible for the acute toxic effects reported in humans but not reproduced in animals. Animal experiments may underestimate the toxicity of sulfur oxides as a consequence. From this overall body of experimental and observational data, it is apparent that population exposures to the sulfur oxide/particulate complex have been a significant public health problem. It is important to note that SO_2 itself is not necessarily the pollutant responsible for the many effects often associated with it. Sulfates and other transformation products of SO_2 are probably a better index of the biologic reactivity of the sulfur oxide/particulate complex.

In a report from a World Health Organization (WHO, 1972a) expert committee on air quality criteria and guides for urban air pollutants, the committee identified concentrations of the sulfur oxide/particulate complex associated with several observed health effects. These associations were largely based on epidemiologic studies. The committee noted that there were limited dose-response data in general, and further that there was little information available concerning the effect of varying one of the components of the sulfur oxide/particulate complex while the other was kept constant. SO_2 and locally associated smoke and suspended particulates were considered as indices rather than as the specific pollutants causing these effects. Numerical estimates of concentrations associated with expected health effects, based on the judgment of the committee, are given in table 12.

According to the committee report, "The numerical value associated with a given effect does not mean that all exposed individuals will be affected. There is no valid information available that permits precise quantification of this risk . . . . The values simply indicate that effects were reported and that the number of those affected was large enough to be statistically different from the number affected in control groups."

The mortality excess cited in table 12 has been observed largely in persons with cardiac or respiratory disease. The range of 250 to 500 μg per m^3 for SO_2 related to exacerbations of disease in patients with bronchitis (also with 250 μg of smoke or particulate matter per m^3) is based on observations in studies conducted in several countries. Higher frequencies of acute respiratory symptoms and diminished ventilatory function may be found in children living in areas where the annual average concentrations for SO_2 and particulates are both greater than 100 μg per m^3. Human annoyance effects have been reviewed in a publica-

TABLE 12

EXPECTED HEALTH EFFECTS OF SULFUR OXIDE/PARTICULATE AIR POLLUTION ON SELECTED POPULATION GROUPS*

Effect	*Pollutant Concentrations (μg/m^3)*	
	SO_2	*Smoke*†
Excess mortality and hospital admissions	500 (0.17 ppm) (daily average)	500 (daily average)
Worsening of patients' pulmonary disease	250–500 (0.08–0.17 ppm) (daily average)	250 (daily average)
Respiratory symptoms and ventilatory function changes	100 (0.04 ppm) (annual arithmetic mean)	100 (annual arithmetic mean)
Visibility and/or human annoyance effects	80 (0.03 ppm) (annual geometric mean)	80 (annual geometric mean)

Definition of abbreviations: SO_2 = sulfur dioxide; ppm = parts per million.

*Source: World Health Organization (1972a).

†British Standard Practice (Ministry of Technology, 1966). See text for comparability with U.S. methods.

tion from the U.S. DHEW (1969b) and have been associated with annual average concentrations of 80 µg per m³ for sulfur dioxide and particulates.

The numerical concentrations given in table 12 have not been substantially modified by any new evidence acquired since the report of the WHO expert committee. It should be noted that the air monitoring methods used for generating the air quality data listed in table 12 are not the standard methods used by U.S. federal and state air pollution control programs and are not, therefore, directly comparable with U.S. data.

Particulate concentrations in table 12 are based largely on the British smoke filter, the measurements of which cannot be related to U.S. total suspended particulate concentrations in any simple way. From a 10-year study by Commins and Waller (1967) of side-by-side measurements with the British smoke filter and the U.S. high volume sampler, it was found that the U.S. method yielded results that were on the average about 100 µg per m³ greater than the British values. Discrepancies became more pronounced in windy conditions and less divergent during episodes of heavy pollution when smoke concentrations were greater than 1,000 µg per m³. In the range of 100 to 200 µg per m³, as determined by the British smoke filter, the U.S method gave results that were approximately twice as high. At 500 µg per m³ by the British smoke filter method, measurements by U.S. methods were 10 to 20 per cent higher.

Photochemical Oxidants. Substances in the ambient air that possess oxidizing properties greater than that of oxygen are termed "oxidants." The compounds are many, complex, and not entirely characterized. Because they are formed in the atmosphere from precursor pollutants (hydrocarbons and nitrogen oxides) with energy provided by solar radiation, these substances are also termed "photochemical" oxidants. The principal component of photochemical oxidant mixtures is O_3, and most knowledge of the biologic effects of photochemical oxidants is derived from experimental studies of O_3. Peroxyacetyl nitrates, acrolein, hydroxy radicals, and other compounds and radicals have also been identified in the photochemical oxidant complex, but relatively little is known about the human health effects of these substances. A recent detailed review of the health effects of O_3 and photochemical oxidants was prepared under the purview of the Committee on Medical and Biologic Effects of Environmental Pollutants, National Research Council (National Academy of Sciences, 1977e).

The over-all anatomic changes evoked by exposure to O_3 (Stephens and associates, 1971; Bils, 1970; Alpert and co-workers, 1971; Freeman and associates, 1974) are generally the same for different species, but vary with the dose and time course between exposure and response; the junction between the respiratory bronchiole and alveolus has been found to be most affected. The anatomic data strongly support the predictions of the mathematic model of Miller and co-workers (1977). Type I pneumocytes are sloughed and replaced with Type II pneumocytes. Under continuous exposure to 0.54 to 0.88 ppm, the Type II cells replacing sloughed Type I cells develop into a cuboidal form rather than their normal morphology. Fibrosis and thickening of the alveolar wall were characteristically found. Numerous mitotic figures were present, and the hyperplasia was evidenced by adenomatous appearance. The wave of mitotic activity initiated by exposure to O_3 most likely corresponded to the replacement of damaged Type I and ciliated cells. The latter are sloughed at higher concentrations of O_3, leaving denuded patches. At continuous exposure to 0.84 ppm, Freeman and associates (1974) reported approximately 50 per cent mortality after 3 weeks of exposure.

Using the infectivity model, increased susceptibility to airborne infectious agents has been detected with concentrations of O_3 as low as 0.08 ppm for 3 hours (Coffin *et al.*, 1968). Alveolar macrophage function is inhibited at higher concentrations and may be one of the principal causes for increased susceptibility. Macrophages isolated from the lungs of rabbits exposed to 0.5 ppm of O_3 for 8 hours per day for 7 days, for example, were more susceptible to osmotic shock (Dowell *et al.*, 1970 [99]). Membrane changes could also be detected as soon as 3 hours after exposure to 0.5 ppm (Hadley *et al.*, 1977 [169]).

Pulmonary edema, an acute response to O_3 exposure, is frequently detected by transudation of serum proteins. The threshold dose for the production of edema depends on the sophistication of the method used for detection of leakage and probably is approximately 0.25 to 0.5 ppm for 6 hours in the rat (Alpert *et al.*, 1971 [6]).

The mechanism of toxic action of O_3 remains obscure. Two theories have been proposed (Menzel, 1976 [259]). The first is that O_3 oxidizes small molecules, such as reduced glutathione and reduced pyridine nucleotides, and promotes the formation of mixed disulfides with proteins. The second suggests that lipid peroxidation is the dominant feature. Evidence for both theories is unfortunately indirect. Vitamin E intake at 100 mg per kg of diet, but not at 10 mg per kg of diet, is protective to mice and rats (Donovan *et al.*, 1977 [97]). The O_3-initiated peroxidation of tissue unsaturated fatty acids leads to biologically active compounds (Roycroft *et al.*, 1977 [326]). Arachidonic acid, for example, is converted to potent peroxides resembling the activity of the naturally occurring prostaglandins G_2 and H_2. These products aggregate human platelets and contract aortic and fundus smooth muscle strips at concentrations equivalent to the naturally occurring prostaglandins (approximately 1 to 10 *nM*). Vitamin E abolishes their biologic activity if present during their formation, but not afterwards. Exposure to O_3 results in an increase in the concentration of glutathione peroxidase in lung tissues and has been suggested as an enzymatic defense mechanism by which these biopotent compounds can be destroyed (Chow *et al.*, 1974 [72]). From these data, it is likely that O_3 forms different products than does NO_2 on peroxidation of tissue polyunsaturated fatty acids. Thus, whereas vitamin E is effective in preventing the toxic effects of both, the biochemistry may be dissimilar.

Another important feature of O_3 toxicity has been the demonstration of hepatic effects. Mice exposed to O_3 have prolonged sleeping times when injected with pentobarbital (Gardner *et al.*, 1974 [139]). Inhibition of lung aromatic hydrocarbon hydroxylase, one of the cytochrome P450 enzymes, has been found on exposure to O_3, but not to NO_2 (Goldstein *et al.*, 1975 [154]). The decreased activity of cytochrome P450 could have broad implication for over-all metabolism of foreign compounds by exposed populations, but insufficient data are available to extrapolate to human health effects at this time.

In experimental studies of human volunteers (Section 2) 2-hour exposures to O_3 in the range of 500 to 1,480 µg per m³ (0.25 to 0.74 ppm) induced decrements in ventilatory function of lightly exercising subjects (Hazucha *et al.*, 1973; Bates and Hazucha, 1973; Hackney *et al.*, 1975a, b,c, 1977a). Greater degrees of activity were associated with changes in ventilatory function of "sensitive" subjects and with respiratory symptoms in most subjects tested, at concentrations as low as 300 µg per m³ (0.15 ppm) for 1 hour (DeLucia and Adams, 1977). Similar effects of increased exercise have been reported by Folinsbee and associates (1975). Repetition of exposures daily for

4 days resulted in diminution of the ventilatory response to the same O_3 concentration, suggesting some degree of adaptation (Hackney *et al.*, 1977b). Tolerance to repeated O_3 exposure has also been reported in animals (Stokinger and Scheel, 1962). Von Nieding (1977) reported a significant increase in airway resistance after 2-hour exposure of lightly exercising subjects to O_3 concentrations as low as 200 µg per m³ (0.1 ppm). These results, however, are generally inconsistent with those of the previously cited investigators, and differences in methods for measuring airway resistance or other factors may explain the discrepancies.

Some studies suggest that mixtures of SO_2 at 1,000 µg per m³ (0.37 ppm) and O_3 at 740 µg per m³ (0.37 ppm) are more active in terms of ventilatory function decrement than would be expected from the behavior of the gases acting separately (Hazucha and Bates, 1973). More recent studies (Bell *et al.*, 1977 [38]) find considerably less ventilatory response to the same combination of gases.

Epidemiologic studies of the health effects of exposure to photochemical oxidants were mostly conducted in the Los Angeles Basin where "oxidant" or O_3 measurements were obtained. Quantitative interpretation of these studies is made difficult by the simultaneous presence in ambient air of other reactive pollutants including NO_2, sulfuric acid aerosols and sulfate compounds, and several reactive but short-lived pollutants, such as peroxy and hydroperoxy radicals. Other factors (e.g., meteorology) may also confound interpretation. Nevertheless, aggravation of asthma (Schoettlin and Landau, 1961), impairment of lung function in chronic bronchitis subjects (Motley *et al.*, 1959; Schoettlin, 1962; Balchum, 1973) interference with track performance of high school students (Wayne *et al.*, 1967), eye and respiratory irritation and headache (Hammer *et al.*, 1974), and increased frequency of motor vehicle accidents (Ury, 1968) have been reported in association with ambient oxidant concentrations. These results are generally isolated findings that require replication in other population groups. Other studies addressing the question of possible excess chronic obstructive lung disease related symptoms or pulmonary dysfunction have generally reported negative results (Cohen *et al*, 1972a; Linn *et al.*, 1976).

Selected examples of health effects related to photochemical oxidants at ambient or near ambient concentrations are summarized in table 13.

TABLE 13

SELECTED EXAMPLES OF HEALTH EFFECTS OF PHOTOCHEMICAL OXIDANTS AND OZONE AT AMBIENT OR NEAR-AMBIENT CONCENTRATIONS

Concentration (µg/m³)	*Duration of Exposure*	*Effect*
1,000-2,000 (0.5-1.0 ppm*), ozone	3-6 hours	Lesions at junction of respiratory bronchiole and alveolus: hypertrophic epithelium, exfoliation of cells, swelling of epithelial alveolar lining cells, replacement of Type I with Type II pneumocytes (Stephens *et al.*, 1971; Bils, 1970; Alpert *et al.*, 1971; Freeman *et al.*, 1974)
500-1,000 (0.25-0.5 ppm), ozone	2-6 hours	Increased pulmonary flow resistance and frequency of breathing in animals (Murphy *et al.*, 1964; Yokoyama, 1969; Watanabe, 1973)
100-600 (0.05-0.3 ppm), ozone	½-6 hours	Depression of gross motor activity, decreased voluntary running and longer learning time (Konigberg and Backman 1970; Murphy *et al.*, 1964; Stokinger, 1965; Litt *et al.*, 1968)
160-800 (0.08-0.4 ppm), ozone	3-4 hours	Increased susceptibility of animals to induced respiratory infections (Coffin *et al.*, 1968; Alpert *et al.*, 1971; Coffin and Gardner, 1972; Goldstein and Hoeprich, 1972)
500-1,480 (0.25-0.74 ppm), ozone	2 hours	Decrease in measures of lung function in experimentally exposed exercising subjects (Hazucha *et al.*, 1973; Bates and Hazucha, 1973; Hackney *et al.*, 1975a, b, c, 1977a)
200-600 (0.1-0.3 ppm), oxidants	1-4 hours	Increased frequency of eye irritation, cough, chest discomfort, and asthma observed in epidemiologic studies of exposed groups (Schoettlin and Landau, 1961; Hammer *et al.*, 1974)

*parts per million.

The national primary standard for photochemical oxidants is 160 µg per m³ (0.08 ppm), a maximal 1-hour average concentration not to be exceeded more than once per year. In a report prepared for the Committee on Public Works of the U.S. Senate (National Academy of Sciences, 1974), the Panel on Photochemical Oxidants and Ozone of the Committee on Medical and Biological Effects of Environmental Pollutants concluded:

> "In the absence of specific criteria of acceptability of health risks, the following judgment of the current oxidant standard is made on the basis of the available information:
>
> 1. Adverse health effects from short-term exposure to photochemical oxidants and ozone at the standard concentrations have not been observed in man.
>
> 2. There are human and animal data that suggest that adverse health effects might be expected at concentrations near the standard, especially under conditions of long-term exposure or in the presence of copollutants."

Nitrogen Dioxide

NO_2 is an oxidation product of nitric oxide (NO), which in turn is produced by fixation of atmospheric nitrogen with oxygen under conditions of high-temperature combustion. Of the 2 oxides of nitrogen commonly monitored in ambient air, NO is relatively nontoxic at ambient concentrations, whereas NO_2 has many biologic effects similar to that of O_3 but on a mole-for-mole basis is less acutely toxic.

Morphologic studies of animals exposed continuously to concentrations as low as 376 µg of NO_2 per m³ (2 ppm) have revealed distinct alterations in the alveoli and respiratory bronchioles (Freeman *et al.*, 1968 [130]). Type I pneumocytes are replaced by Type II pneumocytes after their desquamation and sloughing. The bronchiolar epithelium also exhibits loss of ciliated cells and crystalloid-type inclusions following exposure to high concentrations of NO_2 (18,800 to 22,500 µg per m³, or 10 to 12 ppm). As with O_3, the major site of alteration is near the junction of the respiratory bronchiole and the alveolus. Interstitial edema and collagen deposition occur. On lifetime exposure, dorsal kyphosis occurs in continuously exposed rats. In general, a wave of cell replication has been observed after exposure as Clara and Type II cells replace the injured Type I and ciliated cells. The cell replication can lead to an adenomatous hyperplasia, but no evidence has been presented for an increased incidence of malignancy or tumor formation. A new wave of cell replication can be initiated by exposure to a higher concentration of NO_2, and therefore, complete adaptation to NO_2 does not occur.

Continuous exposure to 18,800 µg of

NO_2 per m^3 (10 ppm) for 75 to 90 days is required for the development of emphysematous lesions in the rat, rabbit, cat, and monkey (56, 134, 214, 320). Mice exposed to 940 μg of NO_2 per m^3 (0.5 ppm) for 12 months had much of the same morphologic alterations as at high concentrations (Blair *et al.*, 1969 [44]). Clear-cut dose-response data are not available, but the concentration of NO_2 seems more important than time of exposure in determining response.

The susceptibility of a number of species to airborne infection is decreased by previous exposure to NO_2. This model is referred to as the infectivity model and frequently uses *K. pneumoniae* and *S. pyogenes* as the infectious agents. Mice, hamsters, and monkeys had increased mortality after exposure to an airborne infectious agent after NO_2 exposure. Using mice, Gardner and co-workers (1978 [140]) studied the effect of NO_2 concentration and time of exposure on the excess mortality due to a standard aerosol of *S. pyogenes*. An exposure as short as 3,760 μg per m^3 (2 ppm) for 3 hours caused increased mortality. Using a constant value of the product of the concentration of NO_2 and time, these workers found that sufficiently long exposure (16 days or more) produced increased mortality with a concentration as low as 940 μg per m^3 (0.5 ppm), but that in all cases the concentration of NO_2 was more important than the time of exposure in determining mortality. In an attempt to model the natural diurnal exposure of humans to peak concentrations superimposed on a continuous background, Gardner and associates (1978 [140]) compared the effects of continuous versus intermittent exposure to 2,820 to 6,580 μg per m^3 (1.5 or 3.5 ppm) NO_2. The effects of intermittent exposure (7 hours per day, 7 days per week) were less than those of continuous exposure until 10 days of exposure to 2,820 μg per m^3 (1.5 ppm), whereas no difference was observed between intermittent and continuous exposure to 6,580 μg per m^3 (3.5 ppm). Such observations suggest that short-term exposures may be more toxic than was previously supposed and raise concern over concentrations higher than 940 μg per m^3 (0.5 ppm) even for short periods of time.

Increased infectivity produced by airborne infectious agents may be due to the inhibition of alveolar macrophage function. Decreased phagocytosis *in vitro* (Gardner *et al.*, 1969 [138]) and membrane damage (Hadley *et al.*, 1977 [169]) have been found with macrophages isolated from mice, guinea pigs, and rabbits exposed to concentrations of NO_2 as low as 7 ppm for 24 hours.

Both O_3 and NO_2 mortality are profoundly influenced by the diet of animals. Rats and mice are more resistant to NO_2 exposure when fed large amounts of vitamin E (100 mg per kg of diet) but not when fed smaller amounts (10 mg per kg) or none (Menzel *et al.*, 1972 [258]). Amounts comparable to that found in the average U.S. human diet (10 mg of vitamin E per kg of diet) provide little or no added protection against lung edema of mice exposed continuously to 24,500 μg of NO_2 per m^3 (13 ppm).

Lipid peroxidation has been suggested as the principal molecular lesion leading to the toxic effects observed on NO_2 exposure (259, 321). It has been suggested that vitamin E acts to prevent excessive peroxidation, thus providing an explanation for the effect of dietary vitamin E on NO_2 and O_3 toxicity (123, 258). An alternative system of detoxification of lipid peroxides by the enzyme system glutathione peroxidase has been proposed (Chow *et al.*, 1974 [72]), but long-term exposure to NO_2 does not enhance this enzyme, and its concentrations were decreased in guinea pigs exposed continuously to 940 μg of NO_2 per m^3 (0.5 ppm) for short periods of time (7 days) (Menzel *et al.*, 1977 [260]). Other enzymatic markers of damage were increased by short-term but not by long-term exposures.

Distal effects beyond the lung appear to occur with NO_2 exposure. Serum cholinesterase, indicative of hepatic damage, was decreased by long-term exposure to 940 μg of NO_2 per m^3 (0.5 ppm) for 4 months (260). Drodz and associates (1976) and Kosmider (1975) reported similar indications of hepatic damage, including decreased serum cholinesterase, albumin, seromucoid, and alanine and aspartate transaminases in guinea pigs exposed continuously to 1,880 μg of NO_2 per m^3 (1 ppm) for 180 days.

Experimental exposures of humans with chronic bronchitis to concentrations of 3,000 to 3,760 μg of NO_2 per m^3 (1.6 to 2.0 ppm) for 15 min produced a detectable increase in airway resistance (von Nieding *et al.*, 1971, 1973). After exposure to 9,400 μg per m^3 (5 ppm), normal subjects exhibited increases in the alveolar-arterial PO_2 gradient (von Nieding and Krekeler, 1972) and diminished single-breath diffusing capacity of the lungs (von Nieding *et al.*, 1973). Certain aspects of these studies are not clear because some of the methods used are not customary in the United States. Rokaw (1968) found that some subjects with chronic respiratory disease had increased airway resistance during rest, beginning at 3,800 μg per m^3 (2 ppm) and during exercise at 2,800 μg per m^3 (1.5 ppm).

Orehek and co-workers (1976) evaluated the combined effect of NO_2 and a bronchoconstricting agent. Twenty asthmatic patients were exposed in a randomized sequence to unpolluted air and to 210 μg of NO_2 per m^3 (0.11 ppm) for 1 hour on separate days. NO_2 exposure alone caused significant increase in specific airway resistance in 3 of 20 subjects. However, NO_2 exposure, compared with unpolluted air, increased the bronchial sensitivity to the bronchoconstricting agent, carbachol, in 13 of the 20 asthmatic patients; the mean dose of carbachol that produced a 2-fold increase in initial specific airway resistance was decreased from 0.66 mg under control conditions to 0.36 mg ($P < 0.001$) under conditions of NO_2 exposure. In the remaining 7 subjects, NO_2 neither modified the initial airway resistance nor affected the bronchoconstrictor effect of carbachol.

Relatively few epidemiologic studies in which NO_2 exposure was the suspected primary environmental pollutant have been reported. Petr and Schmidt (1966, 1967) found a 2-fold excess in acute respiratory disease among 7- to 12-year-old children living near a chemical complex in Czechoslovakia. Nitrogen oxide exposures, which were not further specified in the reports, were moderately low (annual average less than 0.035 ppm) in the towns near the chemical complex. In the Chattanooga studies (Shy and colleagues, 1970a, 1970b; Pearlman and co-workers, 1971a), school children and their families living near a large stationary source of NO_2 were found to have a significant excess of acute respiratory disease episodes, when compared wtih families of similar socioeconomic status in nearby neighborhoods with lesser exposure. Elementary school children and infants living in the high-exposure community for 2 or more years also experienced increased bronchitis morbidity. Interpretation of the results, which suggested an adverse effect in areas with average NO_2 concentrations of 150 to 282 μg per m^3 (0.08 to 0.15 ppm), has been difficult because of unreliability of the method for monitoring NO_2 (Shy and associates, 1973), and by the simultaneous presence of other reactive pollutants including sulfates and nitrates.

As previously noted, Melia and associates (1977) reported a greater incidence of lower respiratory illnesses in British children residing in homes using gas versus electricity for cooking. Illness rates were adjusted for social class, crowding, age, sex, latitude, and other potentially confounding factors. No information was available on smoking habits of household inhabitants, but the authors judged that correction for social class and other factors probably controlled for differences in smoking as well.

The health effects associated with ambient or near-ambient concentrations of NO_2 are summarized in table 14.

After occupational exposure to high concentrations of NO_2—e.g., in miners exposed to "nitrous fumes" from nitroglycerine, workers exposed to fumes from nitric acid reacting with organic material, or astronauts exposed in space capsules to N_2O_4 from rocket fuel—delayed pulmonary reactions occurred and led to pulmonary impairment 1 to 3 days after exposure. Pulmonary edema appears to be a critical mechanism for such acute toxicity. Whether there occur similar delayed effects from lower, ambient NO_2 concentrations is unknown.

Carbon Monoxide

Emissions from motor vehicles constitute the largest source category for ambient concentrations of CO. An important characteristic of CO is that it has neither color nor odor and is not a primary irritant to mucous membranes or the epithelial lining of the respiratory tract. Hence, its presence and deleterious effects in ambient air are not readily perceived by exposed persons. The mechanisms of CO toxicity are better understood than those of any pollutant produced by combustion of fossil fuels.

TABLE 14

SUMMARY OF HEALTH EFFECTS OF NO_2 EXPOSURE AT AMBIENT OR NEAR AMBIENT CONCENTRATIONS

Concentration ($\mu g/m^3$)	*Duration of of Exposure*	*Effect*
Animal studies		
3,760 (2 ppm)	Continuous	Alterations in alveoli and respiratory bronchioles of laboratory animals: Type I replaced by Type II pneumocytes, wave of cell replication and loss of ciliated cells (Freeman *et al.*, 1968 [130]).
940 (0.5 ppm)	Continuous for 12 months	Development of emphysematous lesions in mice: ciliary loss, alveolar cell disruption, expanded alveoli and progressive pulmonary parenchymal damage (Freeman *et al.*, 1968a and b, Blair *et al.*, 1969).
2,[illegible] (1.5 ppm)-6,580 (3.5 ppm)	Continuous for 16 days or more Intermittent exposure	Increased mortality in mice exposed to airborne infection of bacterial pathogens (Gardner *et al.*, 1969, Ehrlich, 1966).
Human studies		
3,000-3,760 (1.6-2.0 ppm)	15 min.	Increased airway resistance in experimentally exposed normal subjects and in persons with chronic bronchitis (von Nieding *et al.*, 1971, 1973).
210 (0.11 ppm)	1 hour	Increase in the airway response of asthmatics to a bronchoconstricting agent (Orehek *et al.*, 1976).
150-182 (0.08-0.10 ppm) in combination with other pollutants	Several years	Increased incidence of acute respiratory disease in school children and their parents (Shy *et al.*, 1970a and b and in children 1-3 years of age (Pearlman *et al.*, 1971).
Estimated peak exposures of 940-1,880 (0.5-1.0 ppm)	Daily for under-determined intervals	Increased incidence of lower respiratory infections among children residing in homes using gas versus electricity for cooking. Illness rates adjusted for social class, age, sex, crowding, and latitude. (Melia, 1977)

Definition of abbreviations: NO_2 = nitrogen dioxide, ppm = parts per million.

The effects of CO stem primarily from its affinity with oxygen-carrying hemoproteins, particularly hemoglobin, thereby displacing oxygen from the red blood cell. CO absorption through the lungs in sufficient quantities results in a physiologic effect similar to that of anemia, in that the oxygen content of whole blood is decreased. Because of the leftward shift and steeper slope of the oxyhemoglobin dissociation curve induced by CO, removal of the same amount of oxygen from blood that perfuses body tissue will result in a greater decrease in the partial pressure of oxygen in the venous blood of the CO-poisoned person than in an anemic person (Bartlett, 1973). The ultimate effect of CO-induced impairment of the oxygen transport system is a tissue deficit of oxygen such that normal function may not be sustained.

TABLE 15

SUMMARY OF HEALTH EFFECTS OF CO AT AMBIENT OR NEAR AMBIENT CONCENTRATIONS

*COHb Concentration (%)**	*Ambient CO Exposure (mg/m^3) Required to Produce Stated COHb*		*Effect*
	1 hour	*8 hours*	
2.5-3.0	79-97 (70-85 ppm)	17-21 (15-18 ppm)	Decreased exercise capacity in patients with angina pectoris (Aronow *et al.*, 1972; Aronow and Isbell, 1973; Anderson *et al.*, 1973)
3.0	97 (85 ppm)	21 (18 ppm)	Earlier onset of leg pain in exercising subjects with peripheral arteriosclerosis disease (Aronow *et al.*, 1974)
3.0-6.5	97-239 (85-207 ppm)	21-52 (18-45 ppm)	Impairment of vigilance tasks in healthy experimental subjects (Beard and Wertheim, 1967; Beard and Grandstaff, 1970; Horvath *et al.*, 1971; Groll-Knapp *et al.*, 1972; Fodor and Winneke, 1972)
5-20	176-887 (155-775 ppm)	38-193 (33-170 ppm)	Linear relationship between COHb and decreasing maximal oxygen consumption during strenuous exercise in young healthy men (Horvath, 1973; Ekblom and Huot, 1972)

Definition of abbreviations: CO = carbon monoxide; COHb = carboxyhemoglobin; ppm = parts per million.

*These are not equilibrium concentrations, but represent an increase in COHb above background (0.5 per cent) to the stated concentration during the interval of exposure.

In table 15, the known health consequences of CO-induced tissue deficits in oxygen are summarized. Persons who are unable to compensate for oxygen deprivation by increased blood flow to affected organs are particularly susceptible to experience adverse effects at relatively low exposures to CO. Thus, persons with arteriosclerotic coronary vessels would be particularly susceptible to cardiac manifestations of low exposures to CO. Three separate studies have shown that persons with coronary heart disease, as manifested by angina pectoris, exposed to CO sufficient to raise blood concentrations to 2.5 to 3.0 per cent carboxyhemoglobin (COHb) saturation, when compared with exercise while breathing CO-free air (Aronow and co-workers, 1972; Aronow and Isbell, 1973; Anderson and associates, 1973). In another study, investigators demonstrated onset of leg pain in men with peripheral arteriosclerotic disease after less exercise when COHb concentrations were increased to 3.0 per cent as compared to background COHb concentrations (Aronow and co-workers, 1974). In the absence of CO exposure, COHb concentrations are approximately 0.5 per cent. One-pack per day cigarette smokers may achieve COHb saturations of 4 to 7 per cent. For nonsmokers, exposure to CO at a concentration of 10 mg per m^3 (9 ppm) for 8 hours or to a concentration of 40 mg per m^3 (35 ppm) for 1 hour—the present U.S. primary air quality standard for CO—is calculated to cause an increase in COHb concentrations to 1.5 per cent during the interval of exposure.

During heavy muscular exercise, the oxygen consumption rate of the whole body places maximal stress on the oxygen transport system, and the ability of the cardiovascular system to transport oxygen to exercising muscles is a determinant of the maximal sustained rate of work that a normal person can perform (Mitchell and co-workers, 1958). Thus, CO has been shown to have predictable effects on young healthy men undergoing strenuous exercise (Horvath, 1973; Ekblom and Huot, 1972); over the range of COHb concentrations from 5 to 20 per cent, a linear relationship existed between increasing COHb and decreasing maximal oxygen consumption. From these studies, there was no evidence for a threshold concentration of COHb, nor is such a threshold predictable from theoretic considerations (Bartlett, 1973).

Suspected long-term effects of CO on arteriosclerosis and vascular disease can be inferred from studies of smoking and occupational exposures. The role of community CO pollution may be very substantial but difficult to detect.

The effect of CO exposure on central nervous system function has been investigated both in humans and in laboratory animals. In humans, several studies have shown impairment of vigilance tasks under well-controlled experimental conditions when COHb concentrations were increased to 3.0 to 6.5 per cent (Beard and Grandstaff, 1970; Horvath and associates, 1971; Groll-Knapp and co-workers, 1972; Fodor and Winneke, 1972). In these tests, the subjects' ability to maintain a high degree of vigilance in a monotonous environment was evaluated. At higher COHb concentrations, no effect on psychomotor function was observed in subjects given tasks to which they could give full attention (Stewart and associates, 1970; Mikulka and co-workers, 1970). The results suggest that exposure to low concentrations of CO may have an effect on central nervous system function principally in a distracting and monotonous situation, but that the CO effects can be overcome by full attention to an intellectual task (Horvath, 1973).

Epidemiologic studies by California investigators (Cohen and associates, 1969) have suggested an effect of ambient CO exposures on case-fatality rates for persons hospitalized with acute myocardial infraction. A significant added contribution to daily mortality variation in Los Angeles can be shown by including carbon monoxide in the regression equation (Hexter and Goldsmith, 1971).

In summary, CO exposure reduces the oxygen content of whole blood and shifts the oxyhemoglobin dissociation curve to the left. With exposures sufficient to raise the carboxyhemoglobin saturation to 2.5 to 3.0 per cent, persons with coronary heart disease or peripheral arteriosclerotic disease may be sufficiently compromised as to experience earlier onset of clinical symptoms on exercising. With slightly greater increases in COHb concentrations, in the range of 3.0 to 6.5 per cent, subtle effects on central nervous system function can be detected. Ambient CO exposures at the present air quality standard have been calculated to permit an increase in COHb saturation to as much as 1.5 per cent.

Other Air Pollutants of Concern to Human Health

Many industries emit their own characteristic types of pollution, and a review of this sort cannot adequately treat such specific pollutants as vinyl chloride, other chlorinated hydrocarbons, hydrogen sulfide, fluorides, tars, arsenic metal fumes, etc. Further, new technical and commercial products, such as exhaust catalysts, fuel additives, paint or dry cleaning solvents, will from time to time be emitted into the ambient atmosphere. To some extent, the Toxic Substances Control Act of 1976 will require that data on hazards be available and evaluated. The general situation is likely to be one of fragmentary knowledge about hazards to health, and uncertainty as to the amount of exposure and proportion of persons who are unduly sensitive.

Lead as a community air pollutant has been associated with increased blood lead in adults (Goldsmith and Hexter, 1967; Hasselblad and Nelson, 1975; Johnson and co-workers, 1975) and in children (Landrigan and associates, 1976; Goldsmith, 1974). Most serious lead poisoning in children is due to the combination of pica and access to leaded paint in deteriorating housing. A contribution of motor vehicle emissions to lead in dirt and street dust is proposed to account in part for a general finding that urban children have higher blood lead concentration than do rural ones. In children with high blood lead concentrations living near smelters, evidence of impaired nerve conduction velocity has been reported (Landrigan and associates, 1976).

The earliest impact of increased exposures to lead is on porphyrin metabolism, the process by which the body snythesizes hemoglobin and related materials. Roels and co-workers (1976) have shown that with the same blood lead concentration, children, as compared to adults, manifest more impairment of porphyrin synthesis as measured by free erythrocyte porphyrin, and that women have more impairment than do men.

There have been substantially higher concentrations of atmospheric lead in the Los Angeles area than in other large cities, due to the large contribution of motor vehicle exhaust. In the Los Angeles area, higher blood lead concentrations (presumably reflecting higher body burdens of lead) are found for children and adults in areas with heavier pollution. The California Air Resources Board, with the support of the California State Health Department, has adopted an air quality standard for lead based on health protection considerations. The standard is 1.5 μg per m^3, averaged over 30 days. A national air quality standard of 1.5 μg per m^3 for lead has also been proposed by the U.S. Environmental Protection Agency.

Although asbestos has attained notoriety as an agent in occupational disease, mounting evidence implies that the general population may also suffer from exposure to asbestos. This suspicion rests largely on 3 observations: (*1*) many persons without occupational exposure have asbestos fibers in their lungs (Langer *et al.* 1971), (*2*) these fibers appear in the ambient air, and (*3*) in some areas, persons without occupational exposure show pathologic changes that indicate a reaction to asbestos (Kiviluoto, 1960). In neighborhoods near asbestos exposure, mesothelioma, a rare cancer resulting from asbestos exposure, sometimes occurs in persons who neither work in the factory nor have relatives who work there. Lung cancer, asbestosis, and mesothelioma pose a substantial threat to persons occupationally exposed. Possible occupational and environmental sources of asbestos exposure include asbestos mines, shipyards, automobile brake linings, fabricating plants, asbestos-rich fire retardant mixtures sprayed on steel-framed skyscrapers, demolition of buildings containing asbestos in construction materials, and possibly asbestos or asbestos-like fibers in crushed rock spread on road beds.

Mercury pollution occurs in a variety of forms from many different sources, but the combustion of fossil fuels accounts for a substantial portion of the atmospheric contamination (U.S. Environmental Protection Agency, 1973). However, even in large industrial cities concentrations of mercury in the air usually remain much lower than 1 μg per m^3 (U.S. Environmental Protection Agency, 1973). Thus far, no large-scale epidemiologic studies have examined the possible effects of such community exposures, but studies of persons occupationally exposed have revealed a dose-response relationship involving the nervous system for concentrations of approximately 0.1 mg per m^3 (Friberg and Vostal, 1971). Because community exposure concentrations generally lie at least ~1 order of magnitude below this value, mercury in ambient air probably represents little if any health problem for the general population.

During the past 30 years, use of beryllium has markedly increased, with metallurgic plants, lamp manufacturing, and production for use in nuclear reactors providing the most likely sources of neighborhood air pollution. Exposure to beryllium can produce acute pneumonitis as well as chronic lesions found mostly in the alveolar walls; both acute and chronic forms appear in neighborhood cases (World Health Organization, 1972b). Because exposures to the Atomic Energy Commission's established standard of 0.01 μg per m^3 in ambient air averaged over 30 days have produced no reported cases of beryllium poisoning, the National Academy of Sciences accepts this as a safe concentration (National Academy of Sciences, 1966).

Like beryllium, cadmium usually has very low concentrations in the ambient air (approximately 0.002 μg per m^3), but near industrial plants that emit cadmium into the atmosphere, the concentrations may reach 0.3 μg per m^3. Compared to the dietary intake of cadmium, airborne particles of cadmium generally present only a minor source of exposure (World Health Organization, 1972b), except in the vicinity of certain high-emission sources such as smelters (Baker *et al.*, 1977). However, cadmium has a very long half-life in the kidney, and it tends to accumulate in the body over time. The inhalation of high concentrations of cadmium dust can lead to severe kidney and lung damage, and because of this metal's cumulative nature, the careful control of community exposures appears to be desirable (Friberg *et al.*, 1971).

Hydrocarbons enter the atmosphere from natural as well as technologic emissions, and transportation accounts for 52 per cent of emissions in the latter category. Other sources include organic solvent evaporation, industrial processes, solid waste disposal, and fuel combustion from stationary sources. In the atmosphere, the alkanes (especially methane) dominate the other abundant hydrocarbons such as the aromatics, olefins, acetylenes, and alicyclics; these hydrocarbons do not include particulates or polynuclear hydrocarbons. Photochemical reactions in the atmosphere can produce other hydrocarbons such as aldehydes and ketones. Hydrocarbons are of particular importance because they may enter the atmospheric reaction process leading to the formation of O_3 and other photochemical oxidants. In their own right, hydrocarbons may induce adverse health effects, although there is relatively little quantitative data to relate individual hydrocarbons to the risk of human disease.

Unlike atmospheric aldehydes, which can irritate the eyes, the primary hydrocarbons released into the air have concentrations much too low to cause any known health effects. However, because these compounds act as precursors for photochemical smog, the ambient concentrations of hydrocarbons in the morning strongly influence the oxidant concentrations in the afternoon under the appropriate meteorologic conditions. Air quality data indicate that nonmethane hydrocarbon concentrations of 200 μg per m^3 (0.3 ppm as carbon) between 6:00 and 9:00 A.M. can produce a maximal hourly average oxidant concentration of 200 μg per m^3 (0.1 ppm) 2 to 4 hours later (U.S. DHEW, 1970c). Because of this effect, the standard for hydrocarbons is set at 160 μg per m^3 for the early morning hours.

Since World War Two, organic pesticides have achieved widespread use. Aerial application and evaporation allow pesticides to become airborne, and the condensation of organochlorine vapors from compounds like DDT onto colloidal particles enhances their ability to travel long distances. Few data exist on ambient air pesticide concentrations in areas remote from the sites of application, but in agricultural areas the typical values fall in the range of 0.1 to 22 mg per m^3. At least for the organochlorine pesticides, the general population receives very little exposure from the ambient air. Communities near agricultural spraying may have significant exposures. Assuming that other pesticides behave in a reasonably similar fashion, exposure through residues in food would have much greater importance (WHO, 1972b) than would atmospheric exposures.

Other organic compounds in the atmosphere may pose a threat to human health. After the discovery that vinyl chloride caused a rare type of liver cancer in occupationally exposed persons, concern has increased at the possibility of general community exposures. Measurements taken within 8 km of vinyl chloride production sources have revealed atmospheric concentrations as high as 33 ppm, although the concentrations usually fall below 1 ppm. These measurements, however, are not necessarily very accurate, but values predicted from an atmospheric dispersion model also fall in the range of 1 to 30 ppm, depending on weather conditions. The appearance of 2 cases of liver angiosarcoma in persons living near vinyl chloride emission sources suggests that such emissions may indeed pose a community threat. In addition to causing liver cancer, experiments with animals indicate that vinyl chloride can damage the spleen, kidney, lungs, brain, and nerve bundles, and occupationally exposed humans have also shown some of these lesions (U.S. Environmental Protection Agency, 1975).

4. Evaluating the Over-all Health Risks of Air Pollution

Are present air quality standards adequate, too stringent, or too lenient for protection of public health? What will be the likely health effects of burning more coal or of postponing achievement of strict automobile emission standards? Do the health benefits of sulfur oxide control justify the high cost of control technologies? These questions are often and reasonably asked by government, industry, and the public; in a sense, they can be reduced to one simple query: what is the over-all health risk of air pollution? The answer is by no means simple, but physicians and lung associations are expected to arrive at well-informed opinions for their communities.

Issues in the Evaluation of Air Pollution/Health Risks

Evaluation of health risks involves 4 component tasks (Lowrance, 1976): (*1*) identifying the health effects of air pollution, (*2*) quantifying these effects at various concentrations, (*3*) estimating how many people are exposed at these concentrations, and (*4*) calculating the over-all health risk associated with a given degree of air quality.

With the abundance of evidence described in Sections 2 and 3, identification of the health effects of air pollution would seem to be reasonably straightforward. Yet there is considerable disagreement even within the scientific community about the health effects of specific pollutants, e.g., whether SO_2, NO_2, or other oxides of sulfur and nitrogen at commonly occurring concentrations are agents of disease in our environment. It is far easier to demonstrate the health effects of air pollution than to determine the health effects of specific amounts of sulfur oxides emitted by fossil fuel power plants, or of photochemical oxidants formed from nitrogen oxides and hydrocarbons emitted by motor vehicles. Moreover, we are concerned not only with acute and readily detectable effects of air pollution, but with cumulative exposures and chronic and often delayed effects. Biologic response to air pollution can range from irritating sensory effects and physiologic changes to disease, disability, and death. We have limited ability to relate these varieties of effects to combinations of air pollutants, and to isolate the effects of air pollution from other causal and contributing factors.

Quantifying air pollution-related health effects at various concentrations entails the formulation of dose-response curves. In figures 4a to 4c, the family of curves that could be drawn for different health effects as modified by factors of age (and other socio-demographic characteristics) and environmental variables other than air pollution is illustrated. That a given increment of air pollution exposure will increase the frequency of some health effects, whereas other effects over the same range of exposures may show no corresponding change, is suggested by figure 4a. In figure 4b is shown the greater susceptibility of older populations at the same concentrations as in figure 4a, whereas in figure 4c the modifying effect of season or temperature on the dose-response relationship is displayed. Each of these illustrations could be partially documented from the body of air pollution/health effects literature. However, there is no single air pollutant and no air pollution-related health effect about which we possess sufficient data to draw a reasonably complete family of curves. There are, therefore, large gaps in our knowledge for answering the question: how many people will experience specific adverse effects as a result of a projected change in exposure to air pollution?

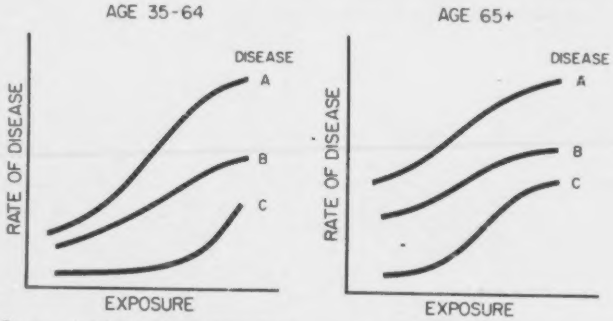
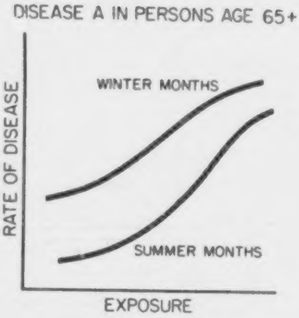


Fig. 4a–c. Hypothetical health damage functions by disease, age, and season.



Even if we identified the range of health effects and the family of dose-response relationships associated with air pollution, we would be hard pressed to obtain a satisfactory set of air pollution measurements of population exposure. Air monitoring networks have not been designed to provide estimates of population doses. Often, a single monitoring station exists in a metropolitan area or in a community of several hundred thousand people, and this monitor is used to estimate the exposure of that population and to differentiate one community from another. Even in these cases, the most sophisticated monitoring stations usually provide data on relatively few air pollutants—those that can be readily monitored with field-test instruments. (For some pollutants, such as CO or lead, breath samples or blood samples may serve as a more accurate integrator of human exposure than elaborate, stationary networks.) Thus, there are many deficiencies of data in studies that attempt to estimate the total population-dose.

To accomplish the final step in risk evaluation, we face the task of calculating the over-all risk to the population of a given degree of air quality. In effect, we would like to apply each set of damage functions for a pollutant to the air pollution dose estimates for all segments of the population. We must engage in this effort despite the many deficiencies in the data concerning the nature of the health effect, the form and position of the family of dose response curves, and the extent of population exposure. Given our present knowledge, estimates of over-all risk are necessarily judgmental in the sense that, to fill in the many data gaps, assumptions must be made that cannot be proved or disproved scientifically. In making these assumptions, scientists are generally aware that they are making judgments that go beyond the narrow limits of scientifically proved facts and that their risk estimates may be modified as more data are acquired. The estimates are, however, useful for suggesting whether an anticipated change in air quality may have an associated health effect and what relative magnitude of effects (or benefits) might be expected from a change in population exposure. Estimates of absolute changes in risk are necessarily much more speculative. Similar processes of estimation in the face of uncertainty occur in many other areas of public policy, such as energy conservation, control of drug use, and pesticide registration.

Because much of our knowledge of air pollution/health effects relationships is based on studies of exposed communities, we may feel more confident in expecting more adverse health effects with increasing population exposure than in defending the judgment that lower exposures will result in a certain quantitative health benefit. Even the expectation of more effects at higher exposure must be qualified by possible temporal changes in modifying factors and in the composition of the pollutants at the higher concentrations.

Examples of Estimates of Air Pollution/ Health Risks

One of the most often cited reports attempting to quantify the total health risk of air pollution is the paper of Lave and Seskin (1970). These authors estimated the impact of air pollution on various disease states by extrapolating from various reported studies and by analyzing the urban factor in lung cancer and chronic respiratory disease. To account for the effect of other contributing factors, they performed a multiple regression analysis in which geographical differences in mortality were expressed as a function of population density, race, sex, age, socioeconomic level, and air pollution (as measured twice monthly at 1 or more monitoring stations in each of 114 metropolitan areas). From this analysis, the authors concluded that a 50 per cent decrease in urban air pollution would be expected to decrease by 25 to 50 per cent the urban excess in mortality and morbidity from bronchitis, 25 per cent of the urban excess in lung cancer and other respiratory diseases, 15 per cent of the urban excess in cancer in general, and 10 per cent of the urban excess in cardiovascular disease mortality. The economic and health consequences of these estimated benefits were further assessed. A decrease in urban air pollution by 50 per cent was projected to decrease health costs by $2 billion and to lead to a 4.5 per cent decrease in the economic costs associated with all morbidity and mortality. In re-analyzing Lave and Seskin's estimates to take account of indirect costs, Barrett and Waddell (1973) computed at $4.3 billion decrease in health costs associated with a 50 per cent decrease in urban air pollution. Waddell (1973) also estimated health benefits of $2.73 billion based on Lave and Seskin's analysis, if air pollution concentrations in all U.S. cities decreased to the concentrations required by the 1970 national air quality standards.

Williams and Justus (1974) also used Lave and Seskin's analysis, but arrived at a smaller estimate of $62 to $311 million for the annual health cost of air pollution. These authors objected that Lave and Seskin's estimates were double-counted, because of the major portion of urban air pollution was represented by SO_2 and particulate pollution data in the multiple regression model, and other economists added health costs attributable to other pollutants, as well. Williams and Justus also assert that cigarette smoking and air pollution are synergistic, whereas the evidence for additive versus synergistic effects is by no means established.

Because each of the above estimates of the over-all health impact of air pollution is based on the analysis of Lave and Seskin (1970), it is desirable to evaluate the quality of the underlying data and the method used by the latter authors to reach their conclusions. As noted in Section 2, many intervening factors can distort the apparent association between air pollution and disease when geographic studies are undertaken. Particularly important as potential confounders are cigarette smoking, social class, and occupational exposures. More-polluted areas are undesirable places to live, hence, higher-income groups with less direct exposure to occupational dusts tend to reside in less polluted neighborhoods. Further, there is ample evidence that professional and managerial groups experience a lower over-all mortality than do other working populations (Ott *et al.*, 1976). Surveys of smoking habits in different occupational categories (Higgins *et al.*, 1977 [185]) also reveal a generally higher prevalence of cigarette smoking among blue-collar than among white-collar workers. Because Lave and Seskin derived their data from census information, they were unable to evaluate possible differences in the distribution of smoking habits and occupational categories in the 114 metropolitan areas of their study. It is not at all unlikely that smoking and occupational differences may have accounted for a significant portion of the mortality and morbidity effects attributed to air pollution.

Lave and Seskin's method of analysis also has serious limitations. By using a geographic or "ecologic" approach to the association between air pollution and disease, they were unable to determine whether the persons who died of lung cancer and other respiratory diseases were actually exposed to the air pollution that was attributed to their metropolitan areas. U.S. populations are very mobile, and a significant fraction of the population in most metropolitan areas is likely to have moved into that area within the past decade. Some persons migrate from low- to high-pollution areas, and others in the opposite direction. Thus, a stationary air monitoring station is not only unrepresentative of the air pollution in an entire metropolitan area, but is also a poor reflection of the cumulative exposure of a highly mobile population. Hence, geographical studies similar to that of Lave and Seskin are unlikely to provide reasonable estimates of differences in population exposure to air pollution. From these considerations, it would appear to be far beyond the quality of the data or the method of analysis to be able to attribute 25 to 50 per cent of the urban excess in lung cancer and other respiratory diseases to a given change in air quality. Too many strong determinants of these diseases were left unmeasured and therefore unanalyzed, and these determinants are very likely to be confounders of the apparent geographic association between air pollution and disease.

The appeal of the approach of Lave and Seskin is that it provides the administrator quantitative estimates of the magnitude of the health benefit to be expected from controlling air pollution at a certain concentration. That these estimates are not based on measures of individual exposure linked to individual causes of death is usually overlooked. It is important to point out that in epidemiologic analyses, geographic associations between aggregate units of observation (such as an entire metropolitan population) are usually limited to generating hypotheses about exposure/disease relationships. To evaluate individual risk of disease from exposure to environmental hazards, epidemiologists rely on morbidity or mortality records that can be linked directly to some estimate of the exposure of the person from whom the record was obtained. At present, evidence from such individual studies has not been accumulated in a standardized or comparable method to allow us to make quantitative estimates that apply to multi-state populations in the United States.

In a chapter written for a report from the National Academy of Sciences, Goldstein (1975) attempted to draw risk estimates that consider constitutional factors, occupational exposure, contribution of cigarette smoking, and the fraction of the population exposed to air pollution. The author recognized that these estimates cannot be based on statistical extrapolations from "hard data," but are instead derived from judgments that necessarily go beyond the limitations of the existing data base. With considerable reservations, he judged that, whereas 70 per cent of chronic respiratory disease is attributable to cigarette smoking, 10 per cent of the prevalence of this disease may be associated with sulfur oxide/particulate exposure. He also suggested that 10 per cent of acute morbidity in patients with chronic obstructive lung disease, 1 per cent of acute respiratory illness, 10 per cent of asthma episodes in polluted communities (5 per cent nationwide) and 2 per cent of total mortality are reasonably associated with air pollution.

Several other air pollution/health risk estimates have been made (North and Merkhofer, 1975; Panel on Air Quality, Noise and Health, 1976; Stolwijk and coworkers, 1975; National Environmental Research Center, 1974). This topic was cently reviewed by Herman (1977) for e American Lung Association.

lthough these estimates vary, in one ense, they all agree in projecting more dverse health effects of air pollution oncentrations greater than those at present, but the relative or absolute magnitude of these increases varies considerably from report to report. In one report (North and Merkhofer, 1975), the effect of variations in underlying assumptions was subjected to a sensitivity analysis, and the magnitude of the resulting health risk was shown to change considerably for some health effects, but not for others.

The issues involved in evaluation of air pollution/health risks, as previously discussed, will not be satisfactorily resolved in the near future. Progress in our understanding of the effects of air pollution on the full range of biologic responses possible in humans, and in measuring population exposure, is time consuming.

The tasks are complex and exceedingly difficult. Nevertheless, existing models of air pollution/health damage relationships can be improved, extended, and tested against new data. Simplifying assumptions can be made more realistic, and other factors that modify the effects of air pollution can be added to the models. The annual expenditure of billions of dollars on control programs surely justifies these efforts.

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The
Business Council
of New York State

TESTIMONY

BY

ROBERT CEROSKY

CHAIRMAN OF THE ENVIRONMENTAL COMMITTEE

OF

THE BUSINESS COUNCIL OF NEW YORK STATE, INC.

BEFORE THE ENVIRONMENT AND PUBLIC WORKS COMMITTEE

Albany, New York

July 1, 1981

The Business Council of New York State, Inc., 150 State Street, Albany, N.Y. 12207 Telephone: 518-465-3547
A consolidation of Associated Industries of New York State, Inc. and Empire State Chamber of Commerce, Inc.

My name is Robert Cerosky and I am Manager of Environmental Protection and Energy Conservation for the General Foods Corporation. I am appearing here today as Chairman of the Environmental Committee of The Business Council of New York State, ~~Inc.~~ The Business Council of New York State, Inc. represents more than 4,000 businesses and over 200 chambers of commerce throughout the State, in addition to representing all of the small business councils ~~throughout~~ the State.

The Business Council of New York views the present Clean Air Act as a laudable concept but one whose inefficient, inconsistent and overly complex requirements need to be restructured if the law's intents and purposes are to be met. From our viewpoint, the following issues identify the most serious deficiencies in the Act that need redress.

Primacy of State Administration

The states and not EPA should be the key administrators of the Act. The present dual regulatory role is extremely inefficient and in many cases, contradictory. A State's Implementation Plan (SIP) should be made the only binding approach to the control of air pollution and the goal of the SIP is the achievement and maintenance of air quality standards. The way each state accomplishes this goal should not be dictated by EPA but considerable flexibility should be allowed to the states in meeting health-related, primary air quality standards. The Act should be amended to clearly state this concept and those present portions of the Act that constrain the state's flexibility should be modified or deleted from the Act.

States should have the role to develop and adopt SIP's - remove EPA's approval procedures. We feel EPA's role is to decide whether or not states are making reasonable progress toward meeting National Ambient Air Quality Standards.

Air Quality Standards

National ambient air quality standards, whose goal is to protect human health, are the basis of the air control program. We feel the standards are a means to identify where public health values are being adversely affected and to indicate steps that are needed to achieve these values. Since we are continually studying both the causes and effects of air pollutants, these primary standards should be periodically reviewed and revised, both to reflect sound, up-to-date scientific evidence and to provide a balance with other important national goals. This review and revision is needed because we believe the original information used to set the primary standards were not based on quality scientific and medical studies. EPA has not adequately considered newer information that seriously questions earlier assumptions. Also, the process by which the standards are set needs to be altered to include the concept of binding peer review. The Act should be amended to include the concept of independent [binding peer review] based on health risk assessment and cost benefit tests. Secondary standards which are not health-related should be viewed as guidelines or goals which the states may set and should not be mandated under the Act.

Administrative Provisions

Since the state should be the primary administrator of the Act, some of the administrative provisions of the Act need to be amended to include the concept that EPA must be a party to the State's Implementation Plan hearings so that EPA's position is known before promulgation of the SIP. If the state adopts portions of the SIP contrary to the attainment of national ambient air quality standards and the state should promulgate such contested SIP provisions, this would constitute a basis for EPA veto of those provisions of the SIP. EPA must, however, veto those provisions within 90 days of state promulgation. Also, minor modifications to the state SIP, that is variances, should be effective upon issuance by the state. Only in the case where EPA can make a showing that such a variance would contravene primary standards would EPA have a basis for veto. These provisions are needed to obtain timely decisions under the Act. Please note that New York State, under Part 70 of the Environmental Conservation Law, has a statutory time schedule established for permit issuing.

Burdendsome Technical Requirements

We recommend simplified requirements namely using BACT to replace LAER, equating BACT to NSPS when promulgated (not when proposed) and that the time period for a permit should be a minimum of ten years after filing. The PSD program is extremely complex and PSD should only be a permitting process related to pristine (Class I) air quality areas established to protect unique resources. Mathematical models that are used in determining compliance or projected compliance can be useful tools; however, when measured data are available, these data should be used in preference to models. The Act needs to be amended to make this policy clear. Also, past practice of EPA using worst case situations should be made more reasonable since worst case rarely, if ever, occurs. LAER for major new facilities in nonattainment areas should be deleted from the Act. Also, RACT for existing sources in nonattainment areas should be tailored to the degree of nonattainment that exists.

Long Range Transport - Acid Precipitation

This concern is an area of active interest and very little is known. Acceleration of research is vital to better understand long range transport, acid formation and effects of transported pollutants before any rational regulatory scheme can be implemented. The Business Council endorses the Acid Precipitation Act of 1980 as a logical process in determining the unknown aspects of this issue. It is our view that the Clean Air Act should not be amended at this point in time to deal with this issue.

Enforcement

We believe the air program would operate more smoothly if the states had the lead role in enforcement - the states have the data. We believe the act should be amended to accommodate this proposal.

Hazardous Pollutants, Coal Conversions, Mobile Sources and the "Bubble"

Other portions of the Act that are in need of corrective action include hazardous pollutants, coal conversion, mobil sources and the treatment of averaging emissions under the "bubble" concept.

The classification of substances as being hazardous under Section 112 should follow the concept identified previously for setting primary air standards; that is, classifying on the basis of scientific evidence subjected to independent peer review that takes into account risks as well as costs and benefits. Revisions to the Act should be made to incorporate these concepts.

Coal conversions can cut costs to all New York State citizens in the form of lower utility bills and in lower costs for goods and services that have an electricity cost associated with them. Ordered conversions or voluntary conversions should be treated the same and conversions without scrubbers, as long as AAQS are met, should be allowed. We recommend that the Act should be amended to allow this.

Averaging emissions from stationary sources under the "bubble" concept should be allowed for new sources as well as old sources, since the basic criteria should be the NAAQS. Flexibility in meeting the NAAQS is needed to reduce the cost of air quality control and a statutory change is needed to allow the use of the "bubble" concept.

The Business Council will provide your Committee with a written statement in the near future, detailing the items that I have touched upon here and more.

We believe the Nation faces an important challenge today - namely - to obtain a program that yields the greatest results from the dollar. Thank you for this opportunity to present The Business Council's views. If you have any questions, I will be happy to respond to them at this time.

clc
7/1/81

POSITION PAPER
of
THE BUSINESS COUNCIL OF NEW YORK
on
CHANGES TO THE CLEAN AIR ACT

Introduction

The Business Council of New York State, Inc. represents more than 4,000 businesses and over 200 Chambers of Commerce throughout the State, in addition to representing all of the small business councils in the State. The Business Council views the Clean Air Act as a laudable concept but one whose inefficient, inconsistent and overly complex requirements need to be restructured. This restructuring is necessary if the law's intents and purposes are to be met. From our viewpoint, the following issues identify the most serious deficiencies in the Act that need to be redressed.

Standards Setting Process

The Clean Air Act is founded upon the concept of protection of public health. In order to protect the public's health, the Act calls for the establishment of technical standards that limit the concentration of various health-affecting materials or compounds emitted to the atmosphere. The present air quality health standards are based on epidemiological studies that have been shown to have serious flaws. In order to have health-protecting standards established in a scientifically-credible way, it is suggested that the Act be amended to incorporate a procedure which will lead to the establishment of better standards.

In particular, an independent panel of experts should be established to review the scientific/medical evidence and to periodically review new findings relative to the health-related effects of various air contaminants. The findings of this panel should be binding. Presently, the Science Advisory Board of EPA is advisory and there have been instances where the EPA Administrator has not heeded the advice of this Board. We also suggest that the basis by which the primary standards are established and reviewed include the concepts of health risk assessment and cost benefit tests. Also, secondary standards should be viewed as guidelines that states may or may not adopt and should not be required under federal statute. A guiding principle on all standards should be to view these standards in a broader societal sense, taking into account economic, energy, as well as other environmental considerations. In all cases, the regulations flowing from the attainment and maintenance of air quality standards should be cost-effective and easy to administer.

Bubbling Emissions

Congress should amend the Act to include new sources within the coverage of EPA's "bubble" policy. That policy provides industry with the flexibility to control multiple sources at a facility in the most economically efficient manner, provided total emissions from the facility do not increase. The Business Council believes that industry should be allowed to meet Clean Air Act new source requirements by "bubbling" the emissions from a new unit with those from existing units at a facility, as long as the total emissions from the facility do not exceed what would have been emitted if the bubbling option were not available.

For instance, one New York electric utility calculated in 1979 that application of the bubble concept to one of its installations, a complex of six fossil-fired units which contains one new unit, would save customers approximately $14 million annually. And this cost savings would be effectuated with a net reduction in the plant's SO_2 emissions over emissions currently allowed. Another New York electric utility estimated that the ability to bubble a new unit with existing units at one of its power plants would have saved its customers approximately $7.8 million in 1979. Savings such as those for New York's electric customers obviously would flow, in part, to the State's industrial and commercial enterprises and would have a salutory effect on the State's economy.

While these examples come from the utility sector, the usefulness of new source bubbling is by no means limited to electric utilities. Every industrial concern having or planning a new installation which is subject to new source performance standards and which is sited near existing facilities potentially can take advantage of the flexibility provided by new source bubbling. The Business Council urges Congress to amend section 111 of the Act to give industry the flexibility to control its facilities, be they existing or new units, in the most cost-effective manner, without any increase in emissions.

Long Range Transport

The movement of air pollutants over distances of hundreds of miles is an issue of considerable discussion since this movement is being suggested as the origin of acids in precipitation. Also, downwind areas are impacted by incurring higher costs for meeting air quality standards since transported pollutants can cause an elevated "background level" in the downwind area.

The regulatory problem being faced by the states and EPA is defining and describing the source-receptor relationships. The ability to do this does not exist today except in the most general and crudest of fashion. The atmospheric chemistry and physics need to be studied so that reasonable cause/effect relationships are understood. There is an urgent need for research in this area so that if additional approachs to address this issue are needed, the course of action will have a reasonable chance of success.

A concerted effort to gain an improved understanding of transport and chemical transformation of air pollutants is contained in the Acid Precipitation Act of 1980. The Business Council suggests that the Clean Air Act not be amended to deal with interstate transport until the scientific basis for taking action has been established. An accelerated program of R & D might be considered.

The State's Role

One of the most vexing problems with the Clean Air Act is the overlapping, and at times, contradictory roles of the state environmental control agency and the federal EPA. The result is a time-consuming, expensive process without benefit.

The state environmental control agency issues air pollution control permits or certificates under state law but in accordance with the State Implementation Plan (SIP) which, in turn, has to be acceptable to EPA. Any changes to the SIP must be reviewed and agreed with by EPA. This dual role results in essentially a "double jeopardy" situation for an applicant. The state's determination is worthless until agreed with by EPA. This was not the intent of Congress but has been interpreted this way by EPA.

Congress must make it abundantly clear that the states and not EPA should be the key administrators of the Act. EPA's role should be one of an auditor to ensure achievement and maintenance of the ambient air quality standards and to arbitrate disputes involving interstate matters. The Act should be amended to give primacy to the states, allow flexibility by each state in meeting the intents and purposes of the law and any portions of the Act that constrain such flexibility should be deleted.

Fugitive Dust

The Clean Air Act's treatment of fugitive dust has a very serious impact on all industries in areas subject to the prevention of significant deterioration (PSD) and increment consumption.

Fugitive dust particulates are produced naturally in many areas during dry weather with strong winds, by man in agricultural practices, vehicular traffic on dirt roads, construction activities and mining. The emissions are highly dependent upon the dryness of the material in the field, roadway or mine and the wind velocity and direction. Most of these variables are extremely hard or impractical to exercise control over. All these sources are very intermittent.

It is for the above reasons that control strategies for fugitive emissions should be treated very differently from stationary sources such as major fossil fuel-burning installations. Recognition must be given that determining compliance with particulate standards and PSD increments for fugitive sources is complex and needs to be treated differently from other sources. We also wish to point out that fugitive dust is essentially harmless from a health standpoint and this fact must be considered in the control strategy.

Therefore, the Business Council suggests that Section 109 be amended to require EPA to consider the difference between harmless fugitive dust and other particulate matter. Amend Section 163 to exempt nontoxic, nonrespirable fugitive dust from all PSD particulate increments.

Mobile Sources

Mobile source requirements of the Clean Air Act require modifications and refinements in many areas. Vehicle emission standards have tended to be established on the basis of ability to comply and the limits of forced technology rather than on need or cost.

The lack of regard for the relationship of an emission standard to its National Ambient Air Quality Standard, the failure to consider the cost and benefits of the standard in terms of effect on the public health and the failure to consider the cost-effectiveness of the standard versus alternative control methodologies have resulted in a body of overly stringent cost-ineffective standards.

Analysis of the trends of ambient air pollution levels of vehicle-related pollutants indicates that current emission standards for CO and NO_x go beyond the levels necessary to protect the public health. EPA projections tend to overpredict emissions when compared to trends measured at 50 monitoring stations.

The Administrator should be required to establish the need for the proposed level of control from a viewpoint based on independent studies of medically significant health effects and costs as a prerequisite to the proposal of standards for motor vehicle emissions.

Since the Act singles out mobile sources for special treatment, specific and detailed discussion of the issues and recommendations to improve the Clean Air Act can be found in the publication, "Recommendations for Revisions: Mobile Source Clean Air Act Provisions and Environmental Regulations," developed by the Motor Vehicle Manufacturers Association of the U.S., Inc.

Coal Conversions

The replacement of oil with domestically produced coal results in reduced foreign source fuel use and decreased cost to electric energy consumers and in the reduced energy cost component of goods and services produced in our Nation. The dual standard that exists for DOE "Ordered" versus "Voluntary" coal conversions should be eliminated. Coal conversions should not be classified as "modifications."

It is in our national interest to encourage coal conversions and decrease impediments to such conversions. The deletion of NSPS, PSD and nonattainment provisions applying to coal conversions would result in a much simplified process for allowing such conversions. The only test for these conversions should be the meeting of primary ambient air quality standards. Also, supplementary controls such as fuel-switching and load reductions during unfavorable meteorological conditions should be statutorily allowed.

Technology Based Requirements

Achievement of primary National Ambient Air Quality Standards (NAAQS) where they are not presently being attained is necessary for the protection of human health. The present Act contains arbitrary deadlines for attainment of NAAQS and associated sanctions for failure to meet these deadlines. These provisions have spawned controversy, uncertainty and administrative strategens to avoid chaos in our economy. Our air is not patently dangerous to breathe. Substantial progress has been made towards attainment of existing NAAQS in all areas of New York, and further progress will continue to be made. The Act should be changed to recognize the realities and complexities of our society and the different requirements of different regions. Arbitrary deadlines should be replaced with goals.

Certain other requirements are unnecessary. For example, in actual practice application of Lowest Achievable Emission Rate (LAER) technology in nonattainment areas has not resulted in an effective use of resources. The small incremental gains in pollution abatement achieved by applying LAER instead of using Best Available Control Technology (BACT) is unreasonable in relation to the added costs. The requirement for LAER for major new facilities in nonattainment areas should be eliminated from the Act. All major new facilities regardless of location should use BACT. Further, where a New Source Performance Standard (NSPS) has been promulgated, this should become BACT.

Presently, there is retroactive application of NSPS to the date of proposal. This is unfair since any construction started after the proposal date but before final rulemaking must meet a standard which may be changed following the public comment period. The public participation process is a mockery unless there is a reasonable expectation of some response to public comments following publication of the proposal. The effective date of NSPS should be the date of promulgation, not the date of proposal.

Requirements for Reasonably Available Control Technology (RACT) for existing sources in nonattainment areas should be tailored to the degree of nonattainment which exists. Major investments should not be mandated to correct minor problems. More flexibility must be provided to allow case-by-case analysis by state agencies in determining the reasonable progress required to achieve attainment. Uncertainties in scientific knowledge of the complex relationship between emissions of volatile organic compounds (VOC) and ozone should be recognized. Excessive regulation of VOC emissions from stationary sources should not be required where exceedances of the NAAQS occur only a few times annually and are not large.

Prevention of Significant Deterioration

The provisions for Prevention of Significant Deterioration (PSD) of Part C, Title I, of the Act are excessively detailed and have produced a regulatory burden beyond what is reasonably necessary to balance air quality and economic growth. EPA regulations and court interpretations have created a nightmare in place of the Congressional dream of an harmonious coexistence of natural and human activities. The experience gained since 1977 with the PSD program suggests the following changes:

1. Abolishment of the increment allotments and associated complex increment tracking requirements for all areas with the exception of Class I wilderness and national park areas. These areas are of true national significance and warrant special protection.

2. In all other areas attaining NAAQS, new sources and modifications of existing sources should be treated equally. Major sources should be

required to install BACT and demonstrate that NAAQS will not be violated. Where a NSPS is promulgated, BACT should be equivalent to NSPS.

3. Preconstruction review of major new sources and modification of existing sources should require monitoring only for those pollutants where NAAQS have been established, only for those pollutants for which the source is a major source, and only where there is some basis for believing a significant violation of the NAAQS for a specific pollutant may occur. Over-reliance on modeling, using worst case scenarios, should be replaced with requirements for regulatory agencies to make decisions based on measured data where available or on prediction models depicting expected conditions.

The Business Council believes such a revised PSD program would eliminate the current waste of resources in meeting unnecessary and complex administrative requirements that are without commensurate benefits. This burden is not justified in those areas where special needs for prevention of significant degradation are not of national importance.

Hazardous Air Pollutants

National Emission Standards for Hazardous Air Pollutants (NESHAPS), promulgated under Section 112 of the Clean Air Act, are intended to regulate and control the emission of air pollutants which do not warrant publication of a NAAQS because the sources are not numerous or diverse. This provision is intended for the regulation of air pollutants which can cause death or serious illness. The present Act directs such standards to be established with "an ample margin of safety." The Business Council agrees that provision must be provided to regulate these special cases of air pollution in order to protect the public health. Unfortunately, the present Act does not:

1. Require the administrator to set forth an adequate scientific basis for his decisions under the Act.

2. Does not provide for independent peer review of proposed actions.

3. Does not provide for consideration of the degree of risk which should be considered in establishing standards. Consequently, the Act has been interpreted to require a "no-risk" approach.

As a result of the uncertainties and difficulties in interpretation of the present Act, emission standards have been published for only four substances designated as hazardous air pollutants. These emission standards cover only specific localized sources of the designated substances. Because of the imprecise language of the Act, it is questionable whether the degree of effort required to establish NESHAPS and defend them in litigation has produced commensurate benefits in protection of the public health.

The Business Council recommends modification of Section 112 to require independent scientific review of data on which listing and standard setting are based, and providing for consideration of degree of risk to replace the "no-risk" concept which has been derived from the present language.

Administrative Provisions

The problems of administration of a complex law such as the Clean Air Act are compounded if certain administrative provisions of the law are absent or are open to interpretation. To decrease administrative problems, the Business Council suggests the following concepts that, if included in the statute, would help to solve some of the more onerous problems of administration.

A. Require EPA to be an active party in the state's SIP hearings so that EPA's position to various parts of the proposed SIP are known before the SIP is promulgated.

B. If a state promulgates portions of its SIP contrary to the attainment of NAAQS, EPA can veto the contravening portion of the SIP but must do so within a fixed time period - say 60 to 90 days. EPA must also make a showing that there is good reason for a veto.

C. Fuel quality variances should be granted by states during emergency fuel supply situations; EPA should not be involved.

D. Any District Court of Appeals should be able to hear Clean Air Act petitions, not just the District of Columbia.

E. Rules and regulation changes involving technical issues should be subjected to peer group review and recommendations by the peer group should be heeded by the Administrator. If the Administrator does not follow such recommendation(s), he must state the basis of his rejection of the recommendation(s) and back up his action with substantive factual support.

TESTIMONY

of

ROBERT F. FLACKE
Commissioner, New York State Department
of Environmental Conservation

before

Committee on Environment and Public Works
United States Senate

Assembly Hall
State University of New York
at Albany
July 1, 1981

Good afternoon. I am pleased to be here today to elaborate on what Governor Carey has said regarding our proposed changes in the Clean Air Act.

First, I want to stress that none of the changes we are recommending should result in any lessening of environmental quality in this State. Rather, however, these modifications are designed to put the Federal law more in touch with the realities of the times.

As the Governor noted, our proposed changes will make the Clean Air Act a viable tool for protecting our nation's environment, without imposing undue economic hardship or bureaucratic impediments.

One of the major concerns of New York involves the serious problem of the long-range transport of acidic pollutants, an issue not addressed in the current law.

The destruction to our lakes and ponds brought about by acid precipitation has been dramatically documented by the Department of Environmental Conservation. To date, an estimated 264 Adirondack lakes and ponds - which once teemed with a variety of aquatic life - are barren. The water has become too acidic to support viable sportfish populations. Thousands of additional acres of ponded brook trout waters are in danger of reaching that critical acid level.

Acidic pollutants fall not only when it's raining, but also when it is not. The impacts of both wet and dry deposition of acidic pollutants are measurable and are adversely affecting not only aquatic life in the Adirondacks, but also vegetation, soils, visibility and buildings throughout the Northeast.

The particulates are so fine that they are respirable and can become lodged in the human lung. The health implications of this are unclear. But what is clear is that these fine particulates are continually falling whether it is raining or not.

In short, the potential environmental and economic damage from acid precipitation clearly goes beyond the destruction of a major aquatic habitat and recreational resource - it is unquestionably one of the most serious environmental problems facing us today.

As Governor Carey noted, we are supporting several amendments to the Act to address this issue including a national program to wash coal with a sulfur content over three percent. Estimates indicate that such a program would result in a reduction in sulfur dioxide emissions from 1½ to 3 million tons per year. Although we cannot say exactly what the impact of this will be on New York State's acid rain problem, we do know that it is a step in the right direction.

For example, New York's total sulfur dioxide emissions are estimated at 1.1 million tons per year. Sulfur dioxide emissions from New York and seven neighboring Northeastern states combined amount to 2 million tons annually - still significantly lower than the 3.9 million tons emitted each year by one state - Ohio - alone.

Conservatively, coal washing would cut the total sulfur loading to the atmosphere by more than 10 percent, and also reduce the contribution by coal-fired facilities by more than 20 percent.

In addition to sulfate particles, acid precipitation also has a nitrate component. Thus, measures are needed to help control nitrogen oxides. In this connection, we would like to see a requirement that coal-fired utilities retrofit their burners to staged combustion or use other techniques to lower nitrogen oxide emissions. Further, we believe that any further relaxation for nitrogen oxide control in automobiles will only exacerbate the acid precipitation problem. Thus, we ask that the Congress remain firm in its position not to relax this standard.

We concur with those who say more research is needed on acid precipitation; however, we do not accept more research as an excuse to do nothing. Those control measures we have outlined should be implemented now. At the same time, the State will continue its research on acid precipitation. It is clear that more information is needed on mechanisms which create acid particles in the atmosphere; the development of long-range transport tracer models to pinpoint the sources of the problem, and stack monitors to "fingerprint" emissions and the impact of acid precipitation on ecosystems and human health. But, the Federal government must play a leading role in such research along with private industry.

In this connection, the utility industry has a special corporate responsibility to not only their stockholders and ratepayers, but also to the larger community which knows no political or geographic boundaries.

The fact is that utilities deliver a product - electricity - and the true and total cost of that product must be paid in the beginning and not postponed to another time, another generation or another region. Because, when the cost is shifted, it grows, not only because of inflation but because of the "ripple effect."

This can be illustrated by the tragic example of Love Canal. If the true cost of producing those chemicals was "internalized" at that time, future generations of New Yorkers would not have been strapped with the inflated cost of remediation and containment - a cost that far exceeded the original cost of disposal.

Since the discovery of Love Canal, New York has pioneered the development of a hazardous waste management program. Now, the nation has joined us in this effort to better manage the production and disposal of hazardous waste and to ensure that the true cost is contained between the generator and the consumer.

Today, acid deposition is posing the same kind of national crisis, and must be given the same kind of priority that society has given hazardous waste management. The true cost of producing electricity can no longer be shifted to another segment of society or transported to another region of the country. Indeed, acid deposition knows no political or geographic boundaries, and impacts areas from Maine to Florida and California to Canada - - a truly national problem demanding a national solution.

The current Federal research program owes its very life to you, Senator, and we commend you for that. We in New York would like to see that program accelerated so that the issue of acid precipitation will be elevated to the priority it demands. Not only should Federal funding be increased, but the timetable for initiation of their research projects should be stepped-up. In addition, an extensive network of monitoring stations for both wet and dry deposition should be established as recommended by the National Commission on Air Quality. This network is essential, along with other key components of the total program required, if we are to determine the long-term trends in acid deposition.

Turning to other issues, we believe additional changes in the Act are long overdue. By 1970, when the Act was adopted, the burning of domestic coal, which after World War II had supplied more than half of the nation's energy needs, had waned and had been replaced by cheaper oil and gas. The unsightly smoke from stacks associated with coal burning disappeared, primarily because of economics - oil and gas were less costly.

In the early 1970's, it became apparent - in a rather abrupt way - that the days of cheap energy were nearing an end. The 1974 oil embargo helped to underscore this fact. It was now starting to become clear that we must begin, once again, to rely on our own country to meet the nation's energy needs. Over the last year we have been moving closer towards our goal of energy independence under the State Energy Master Plan.

At the same time we have been working on this objective we have been making enormous gains in another important area--providing clean air for all citizens. Dramatic progress has been made, including a reduction by nearly half of the total suspended particulates in the air and a decrease, again by about 50 percent, of sulfur dioxide levels. We also have seen significant reductions in other air pollution levels.

Now that we are moving towards an increased burning of coal, some concern has been expressed that air pollution levels may be increased. We, however, believe that coal can be burned cleanly and we are committed to increased use of this "freedom fuel" to satisfy our energy needs.

However, our unified State effort to convert many of our oil burning power plants to coal-fired units has been hamstrung by administrative and bureaucratic obstacles - primarily on the Federal level.

As the Governor noted, the current Act severely hampers conversions to alternate energy sources, such as coal and wood. Accordingly, the State Implementation Plan revision process should be modified to allow New York and other states to revise their SIP in a simplified and straightforward manner. States should be permitted greater flexibility and a freer hand in the SIP planning process. This would result in a more creative plan tailored to the individual needs of each state. Particular emphasis should be placed on elimination of duplicative reviews and overly time-consuming and burdensome procedures necessary for EPA approval. All of this can be accomplished without jeopardizing air quality.

In addition to changes in the Act to address acid precipitation and coal conversions, we believe that the statute must deal with other important issues. Our New York State position paper, copies of which have been supplied to your Committee, outlines some additional modifications which we believe should be made in the Act, including:

-- permitting sources within an air quality control region (AQCR), or an adjoining region, to trade emission reductions between the sources to comply with emissions requirements, resulting in a saving for utility ratepayers and improved air quality;

-- eliminating the incremental limits for air quality degradation in Class II and III areas, while adopting the requirement for the installation of the best available control technology (BACT) on all new sources or major modifications emitting 50 tons per year or more.

Sources outside of, but impacting upon, a Class I area would still be required to meet increment requirements for such an area;

-- clarifying and simplifying EPA requirements for preparation of the State Implementation Plan to eliminate administration and procedural requirements which are time consuming and focus on the least hazardous pollutants, while the more dangerous pollutants are almost neglected;

-- requiring a standard-setting process which would be based on protection against adverse health effects which takes into account public health risks and social and economic impacts;

-- using recommendations from an independent scientific group, such as the National Academy of Science, to establish health and welfare standards, instead of relying entirely on EPA technical experts;

-- publishing of "guideline standards" for secondary air pollutants, again using a scientific committee for advice, so that States may select secondary standards to protect the particular area within each State or air quality control region. The adoption of locally based secondary standards would take into effect the economy of the area. Provision could be made by Congress to protect national parks and wilderness areas (Class I) by imposing appropriate secondary standards if the State fails to take action in such areas.

Our position paper discusses in more detail the various modifications we are proposing. Implementation of these changes would lead to a Federal law that is more equitable and consistent with our State's as well as our nation's environmental and economic goals.

I want to take this opportunity to thank you, Senator Moynihan, for coming to Albany to listen to our views. We know you share our concern over many of these issues - especially acid precipiation, and we commend you for sponsoring the research legislation which is an important first step towards a solution.

We know you agree with Governor Carey that research should not be used as an excuse for inaction. We need immediate action on this and the other important matters I have outlined for you. Today, Congress has the opportunity to improve this landmark environmental legislation. Using the knowledge and experience gained over the last decade, we can ensure that the Clean Air Act accomplishes its original goal to "protect and enhance the quality of the nation's air resources." I hope we can all join in this important effort.

TESTIMONY OF

MARCIA J. CLEVELAND, ASSISTANT ATTORNEY GENERAL
IN CHARGE, ENVIRONMENTAL PROTECTION BUREAU
NEW YORK STATE ATTORNEY GENERAL'S OFFICE

BEFORE THE

U.S. SENATE COMMITTEE ON THE ENVIRONMENT
AND PUBLIC WORKS

JULY 1, 1981, ALBANY, N.Y.

Prepared by:

MARCIA J. CLEVELAND
Assistant Attorney General

MICHAEL H. SURGAN, Ph.D.
Environmental Scientist

SUMMARY OF TESTIMONY

My name is Marcia J. Cleveland. I am the Assistant Attorney General in charge of the Environmental Protection Bureau of the New York State Attorney General's office. I am presenting this testimony on behalf of the Attorney General who regrets that he is not able to be here personally to present this testimony.

The Attorney General strongly supports reauthorization of the Clean Air Act in essentially its present form. We strongly urge that the concept of health-based standards be retained. Both ambient standards which govern the most common pollutants and national emission standards which govern hazardous pollutants must continue to be set at levels which protect, with an ample margin of safety, the more vulnerable parts of the population -- the old, the young and those with respiratory and other health problems.

In addition to retaining the basic structure of the Act as it is now written, the Attorney General urges this committee to consider and recommend to the Senate three strengthening amendments to the Act which are particularly important to New York. First, Congress should require the Environmental Proetction Agency to promulgate a National Ambient Air Quality Standard for fine particles. Second, mechanisms should be placed in the Act which would require EPA to review and regulate hazardous air pollutants faster than it has under the present Act. Third, the interstate pollution sections of the Act should be strengthened to bring about an immediate reduction of interstate pollution.

Fine particles are a problem of great concern to New York. They are a significant health problem because they can be breathed deeply into the lungs, bypassing normal defense and cleansing mechanisms. They also contribute to severe environmental problems. Fine particles are transported into the State from midwestern coal-fired power plants and other stationary sources. In urban areas within the state, this background burden is supplemented by local stationary sources as well as cars, trucks and buses, especially those that use diesel fuel.

In rural areas of New York, fine particles have significant impacts beyond their respiratory health hazards. In the atmosphere, they reduce visibility in important recreational areas of the State such as the Adirondacks. When deposited, as acid rain, snow and fog, or even in the dry form, they cause additional harm.

Since the Clean Air Act was first passed in 1970, EPA has only regulated four hazardous air pollutants, and listed three more for eventual regulation. This inadequate response to the problem of toxic air pollutants is of serious concern to

New York, because New York City, particularly Staten Island, is downwind from the refineries, smelters, pharmaceutical and petrochemical industries of northern New Jersey. These industries are noted for emitting toxic air pollutants most of which are not yet regulated by EPA.

We suggest that the hazardous air pollution section of the Act be strengthened so that EPA is required to identify potential hazardous air pollutants, review them, list them and issued regulations promptly. The problem under § 112 of the present Act is that EPA is under no time limits for the review and listing of pollutants no matter how strong the evidence is that a particular pollutant poses a serious health hazard.

Finally, we recommend that §§ 126 and 110(a)(2)(E) be strengthened to require an immediate reduction in some of the best known interstate pollutants. Our recommendations grow out of the Attorney General's experience litigating the acid rain issue extensively under the present provisions of the Act. Another member of my staff, Mary Lyndon, gave detailed testimony on the interstate provisions before senator Stafford's field hearings in Vermont yesterday. My remarks on these sections will therefore be brief.

I. THE NEED FOR HEALTH BASED STANDARDS

The Clean Air Act of 1970, and as amended in 1977, reflects a strong commitment by Congress to protect public health. Under § 109 of the present Act, National Ambient Air Quality Standards have been established to protect the public from health and environmental impacts of seven ubiquitous pollutants. Under § 112, EPA has the authority to further protect the public health by limiting emissions of specific hazardous pollutants. Under both sections Congress has clearly mandated regulation to protect the public health, with an adequate margin of safety. This protection is extended not only to the "average citizen," the health adult male of most scientific studies, but to the very old, the very young, the infirm and those who might otherwise be especially sensitive. The Act makes no provision for the consideration of costs of compliance in the promulgation of standards. There is ample opportunity for such considerations in the later stages of implementation and enforcement.

The Attorney General of New York believes that the ongoing reconsideration of the Clean Air Act should accept and be guided by these same principles. Full consideration should be given to all adverse health effects which may be reasonably anticipated, not just those of a life-threatening nature. The provisions of the Act should prevent these effects. Finally, Congress should once again direct EPA to establish standards based solely on the mandate to protect human health without consideration of cost. To do otherwise would seriously undermine both the Act and the public health it is designed to protect.

II. THE NEED FOR AN AMBIENT STANDARD FOR FINE PARTICLES

Under the present National Ambient Air Quality Standards fine particles are virtually unregulated, even though it is generally recognized that they pose significant health risks because of their small size and are the cause of visibility reductions. At present fine particles are controlled only as part of the Total Suspended Particulate (TSP) standard. Because the TSP standard limits particulate emissions by weight and fine particulates have negligible weight as compared to coarse particles, the current standard is essentially insensitive to large variations in the concentration of fine particles.

It was recognized in the original criteria document for particulate matter, published in 1969, that fine particles were the prime concern in regard to health impacts.* However, since most early air pollution studies did not specify particle size, the authors of that document chose to deal with particulate matter as a whole.

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* Air Quality Criteria for Particulate Matter, U.S. Dept. of Health, Education and Welfare, Wash. D.C., 1969.

This approach failed to regulate or even develop sufficient monitoring data on fine particles. A particle with a diameter of 0.1 micron has a mass equal to 1 millionth the mass of a 10 micron diameter particle. Thus, small particles may represent 90% of the total number of particles and yet comprise a trivial fraction of the TSP mass. The current standard therefore will allow the accumulation of very high concentrations of fine particles within the established limits. Such a standard discourages the monitoring and research necessary to fully evaluate the impacts of fine particulates, thus promoting the continuation of inadequate regulation.

There is ample scientific evidence on health and environmental impacts to support the adoption of a specific fine particle standard. Fine particles, in the range of 1 to 2 microns in diameter (a micron is 1 millionth of a meter), can bypass the defenses of the respiratory system and be inhaled deep into the lungs.* Once in the lungs, particulate matter can have several different effects. Some fine particles are toxic, with specific recognized health effects. These include sulfates (associated with chronic pulmonary disease), various heavy metals such as beryllium, cadmium, and mercury

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* Perera, F.P. and A.K. Ahmed, Respirable Particles; Impact of Airborne Fine Particulates on Health and the Environment, Ballinger Publ. Co., Cambridge, Mass. 1979.

(which are toxic and carcinogenic), and various organic compounds (which may be toxic and/or carcinogenic).* Fine particles may also serve as carriers for other toxic substances, bringing them deep into the lungs and keeping them there longer than would be possible without the carrier. Such is the case with carcinogenic polycyclic aromatic hydrocarbons.** Finally, some fine particles interfere with bronchial mucociliary clearance.*** This interference with a physiological defense mechanism increases the residence time of other particles in the lung, and may exacerbate their effects. It has been estimated that airborne fine sulfate particles account for almost 187,000 deaths per

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* Wilson, R. _et al._, _Health Effects of Fossil Fuel Burning_. Ballinger Publ. Co., Cambridge, Mass., 1980.

** Perera, F.P. and A.K. Ahmed, _op. cit_.

*** Lippman, M., _et. al._, "Effects of sulfuric acid aerosols on respiratory tract airways." Paper presented at the Fifth British Occupational Hygiene Society International Symposium on Inhaled Particles, Cardiff, Wales, Sept. 1980.

year among the adult white population of the United States.*

In addition to the multitude of serious health effects outlined above, airborne fine particulate matter is responsible for a significant reduction in visibility. Particles in the size range of 0.1 to 1 micron scatter light very efficiently.** Reduction in visibility due to high concentrations of fine particles can be dramatic, especially in otherwise pristine areas. Such visibility impairment has been noted nationwide. Figures 1 & 2*** illustrate the extent to which visibility is affected with two photographs of the same view from Whiteface Mountain. Figure 1 was taken on a clear day with low concentrations of fine particles, while Figure 2 shows visibility impairment due to high levels of fine particulates. Reduction in visibility represents a degradation in the quality of life for all residents of New York State. It tends to reduce revenue from tourists and adversely affect property values in scenic areas.

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* Mendelsohn, R. and G. Orcutt, "An empirical analysis of air pollution dose - response curves" J. Envir. Econ. and Mgt. 6:85-106, 1979.

** Ahlquist, N.C. & R.J. Charlson, "Measurement of the wavelength dependence of atmospheric extinction due to light scatter." Atmospheric Environment 3:551-564, 1969.

*** Samson, P.J. "The transport of suspended particulates into New York State" Interim Report to the N.Y. State Department of Law, June 1981.

Visibility impairment episodes in remote, rural areas indicate that fine particulate impacts are not limited to the regions surrounding specific sources. Particles in the range of 0.1 to 1 micron diameter accumulate in the atmosphere,* and may remain suspended for an average of 80 hours.** Over the course of more than 3 days, these fine particulates may be transported over many miles, adversely affecting health and welfare. Upon deposition far from their source, fine particulates, including acidic compounds, heavy metals and organic carcinogens continue to adversely affect health and welfare in a variety of ways.

The State of New York is especially susceptable to the impacts of transported fine particulates due to peculiarities of its geography and geology. Under prevailing meteorological conditions, New York, and the Northeast in general is downwind of many coal-fired power plants in the Ohio River Basin. These are major sources for fine particles and compounds which contribute to the formation of additional fine particles in the atmosphere. The location of the Adirondack Mountains, and the generally poor capacity of their soils and waters to neutralize acids make them particularly vulnerable to damage from acid forming sulfates, nitrates and other fine particles.

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* Whitby, K.T., "The physical characteristics of sulfur aerosols" Atmospheric Environment 12: 135-160, 1978.

** Rodhe, H. "Budgets and turn-over times of atmospheric sulfur compounds." Atmospheric Environment 12: 671-680, 1978.

Fine particulates also pose a significant threat to human health and welfare in the metropolitan New York City area. During the period of August 22-23, 1976, a special monitoring study revealed that 80% of the TSP in New York City was less than 2 microns in diameter.* It was also noted that almost three quarters of that fine particulate load may have been transported into the region from distant sources. Superimposed upon the background burden of particulates transported into the region, there is a significant contribution from transportation sources, private, public and commercial. This contribution will increase as a result of increased use of diesel engines.** Diesel engines emit 30 to 100 times more fine particulate matter than do gasoline engines.*** Levels of suspended particulate matter in Manhattan, measured well above street level, are generally below the existing NAAQS. There is little information on concentrations attained at street level, where most of the population is exposed. However, under a scenario of rapid dieselization it has been predicted that 65% of the population of Manhattan would be exposed to levels above the current NAAQS by 1990.****

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* Wolff, G.T. et al. "Characterization of Aerosols Upwind of New York City: I. Transport" Ann. N.Y. Acad. Sci. 322: 57-72, 1979.

** Paul, R.A. "The Impact of Future Diesel Emissions on the Air Quality of Large Cities" EPA 450/5-79-005, 1979.

*** The Diesel Emissions Research Program, Program Report - Mobile Source Research Committee, EPA 625/9-70-004, 1979.

**** Paul, R.A. Op. cit.

Similar significant impacts have been predicted for Chicago and Los Angeles.* Keeping in mind that the current standard is weight-based and ignores the special health impact of fine particulates, this situation cannot be allowed to develop. In recognition of this problem, New York City has imposed restrictions on the number of licenses issued for diesel taxis. This is clearly a stop gap measure and cannot address increased dieselization in private cars, trucks and buses. The federal government must take an active lead on this issue. A size-specific standard is required to prevent further endangerment of the public health.

The Clean Air Act directs the Administrator of the Environmental Protection Agency to develop NAAQS for any air pollutant which he finds endangers public health and welfare and arises from numerous and diverse sources. We believe that current evidence amply demonstrates that fine particulates satisfy both of these requirements. The regulation of fine particles should be explicitly addressed in the new Clean Air Act, and EPA should be directed to promulgate a meaningful fine particulate standard without further delay.

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* Ibid.

III. THE NEED FOR A STRONGER MANDATE TO REGULATE HAZARDOUS AIR POLLUTANTS

Under § 112 of the present Act the first steps in the process of regulating hazardous air pollutants are discretionary. The Administrator is only required to list those hazardous air pollutants for which he intends to promulgate emission standards. Once a pollutant is listed, he then has a mandatory duty to issue emission limitations for that pollutant within 180 days. However, the present § 112 does not require the Administrator to review potential hazardous pollutants to determine whether they meet the statutory definition of hazardous, and if they do, to list them.

This incomplete mandate and delays by EPA have resulted in the listing and regulation of very few hazardous air pollutants. EPA has promulgated emission standards for only four pollutants: asbestos, beryllium, mercury and vinyl chloride. The standard for vinyl chloride, the last standard to be promulgated, was issued in 1976. Only three others have been formally listed for regulation under § 112: benzene in 1977, arsenic in 1978, and radionuclides in 1979. In spite of statutory time limits, no standards have been promulgated for these pollutants; indeed, of the three, standards have only been proposed for benzene. This poor performance by EPA must be measured against the large number of potentially toxic chemicals that EPA admits are in our air. An EPA representative recently presented testimony to this committee, that EPA has identified 632 organic chemicals as potential hazardous air pollutants. Of these only 15 are in the latter stages of health assessment.*

Hazardous air pollutants are of particular concern to the State of New York. New York currently regulates emissions of specific "high risk air contaminants" not otherwise regulated under federal law. These efforts to protect the health of our citizens may be compromised by unregulated emissions from neighboring states. New York City, for instance, is in close proximity to and downwind from the major industrialized region of northeastern New Jersey. This portion of New Jersey is known for its high concentration of petroleum refineries, organic and petrochemical industries, smelters and pharmaceutical manufacturers.

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* Testimony of Joseph Padgett, Director of the Strategies and Air Standards Division, Office of Air Quality Planning and Standards, U.S.E.P.A., June 11, 1981, as reported by the National Wildlife Federation's Conservation Report, June 19, 1981.

Recent monitoring programs* directed by the N.J. Department of Environmental Protection have confirmed the presence of many potential hazardous chemicals in New Jersey's air. These studies found six heavy metals, eight selected polycyclic aromatic hydrocarbons and seventeen of twenty selected volatile organic substances in the ambient air. Another monitoring study, sponsored by U.S.E.P.A. detected seventy-three different organic compounds in the ambient air in Newark, N.J. Similar numbers of organic compounds were detected in Staten Island, and various locations in Texas, West Virginia, California, and Missouri.** It is clear that these studies do not define the full variety of hazardous pollutants emitted in metropolitan area. There can be little doubt however, that the emission mix from this region contains a wide variety of carcinogenic, mutagenic, teratogenic and otherwise toxic air pollutants; a mixture of pollutants which can be distributed across the five boroughs by prevailing meteorological conditions.

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* "Second Report on the Findings of the State Monitoring Program for Heavy Metals and Polycyclic Aromatic Hydrocarbons in Ambient Air in New Jersey" and "Second Report on the Findings of the State Monitoring Program for Volatile Organic Substances in Ambient Air in New Jersey." Office of Cancer and Toxic Substances Research, N.J. Dept. of Environmental Protection, 1980.

** Pellizzari, E.D. "The measurement of carcinogenic vapors in ambient atmospheres" Report prepared for the Environmental Sciences Research Laboratory, U.S.E.P.A., Research Triangle Pk., N.C., 1977.

EPA cannot be allowed to proceed with implementation of § 112 at the same rate at which they have acted during the last 10 years. In order to facilitate the regulation of hazardous emissions and reduce their adverse health effects, the Attorney General of New York suggests that Congress require EPA to complete regulation of those hazardous pollutants which have been listed but for which EPA has not yet issued emission standards. We also suggest that § 112 be amended to establish a process for the review and listing of potential hazardous pollutants.

The amendments to § 112, we believe, should be patterned on § 4(e) of the Toxic Substances Control Act which establishes an interagency committee to create a priority list of chemicals to be tested under the Act. Once a chemical is on the list EPA must decide whether or not to issue a testing order on it within one year, and support its decision with reasons.

Applying this system to § 112 we would suggest the following approach:

1) The creation of expert interagency committee to review the human health hazards of all organic chemicals or heavy metals found in the ambient air.

2) The committee would be required to establish a list of no more than 50 hazardous air pollutants, to be given priority consideration for regulation under § 112. The committee

would be encouraged to group pollutants by industry and chemical relationship.

3) EPA would have one year from the time a pollutant is placed on the priority list to decide whether or not it intends to issue an emission limitation for it.

4) If EPA decides to issue an emission limitation for a pollutant it would have 180 days to do so.

5) If EPA decides not to regulate a priority pollutant it would have to support its decision with detailed reasons.

In addition to the above suggestions on how to speed up the listing and regulation of hazardous pollutants we suggest some changes in the way emission standards are set:

1) In situations where health protective limits cannot be attained by available control technology and/or process modification, EPA should be authorized to require reasonably available control technology (RACT) as an interim measure. In cases where RACT is applied as an interim measure, fixed annual decrements in emissions should be required until the emission standard is attained. This approach will force the development of the necessary control technology.

2) Congress should consider the value of supplementing emission standards with a regional emission cap. This would provide much needed protection to the populations downwind of

heavy concentrations of those industries that emit hazardous pollutants.

IV. IMPROVED CONTROL OF INTERSTATE POLLUTION

A. Improvements in the Interstate Provisions

The long range transport of air pollutants from other regions to New York poses a series of significant problems for New York. Out-of-state pollutants contribute very significantly to acid rain, to haze and loss of visibility from fine particles, and to health problems associated with breathing fine particles and hazardous pollutants.

The Attorney General believes that the Clean Air Act, in its present form, contains adequate provisions to deal with most interstate problems, if EPA recognizes and addresses those problems early enough. But our experience with the acid rain issue suggests that EPA does not respond promptly. The following proposals are submitted to clarify EPA's responsibility and facilitate action on interstate pollution:

1. EPA should be required to review all SIP's to make sure they have adequate provisions to prevent interstate pollution. Although EPA was required by the 1977 Amendments to review all SIP's, it did not review their compliance with the interstate provisions of the Act.

2. Interstate considerations, such as prevailing meteorological conditions, atmospheric transformations and

synergism, and deposition mechanisms should be taken into the account in setting ambient levels in the NAAQS.

3. Any state receiving air pollution from out-of-state sources should have the right to petition EPA for a finding of adverse impact.

4. Section 126 should be amended to permit states to file § 126(b) petitions for pollutants not governed by NAAQS.

5. EPA should be required, under § 126, to act to abate recognized interstate pollution problems, even when it is not possible to pinpoint the relationship between a specific source and the injury to a complaining state.

6. In implementing the interstate provisions EPA should be required to achieve equity between regions; that is no one region should be required to limit emissions more stringently than another.

B. Specific Provisions for Acid Rain

New York, and the Northeast in general have long suffered from the effects of acidic deposition due to the transport of pollutants from the Midwest. The principle sources of these pollutants are, clearly, the many coal-fired power plants of the Ohio River Basin. When deposited, in either the wet or dry mode, these pollutants cause a wide spectrum of additional damage.

Acidification of drinking water supplies may cause the leaching of excessive amounts of copper and lead from plumbing systems into drinking water.* Acidic deposition in aquatic ecosystems causes adverse and irreversible impacts, including the extinction of fish populations in sensitive lakes.** Terrestrial ecosystems, including forests and agricultural lands may be damaged when acidic deposition solubilizes toxic heavy metals so that they may be absorbed by plants,*** leaches nutrients from the soil,**** and alters the bacterial and fungal communities which maintain the critical cycling of nutrients in the soil.***** Acting directly on plants, acidic deposition can "damage foliage; accelerate cuticular erosion, alter responses to associated pathogens, symbionts and saprophytes; affect the germination of conifer and hardwood seeds and the establishment of seedlings."******

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* Fuhs, G.W., "A contribution to the assessment of health effects of acid precipitation." In: Proceedings of the Action Seminar on Acid Precipitation, Toronto, Canada, Nov. 1979.

** Hendry, G.L. et al. Geological and Hydrochemical Sensitivity of the Eastern United States to Acid Precipitation. EPA 600/3-80-024, 1980.

*** Altshuller, A.P. & G.A. McBean, "The LRTAP Problem in North America: A Preliminary Overview." Report of the U.S. Canada Research Consultation Group, 1979.

**** Ibid.

***** Raynal, D., "Effects of Acid Precipitation on a Forest Ecosystem" Report to the N.Y. State Energy Research and Development Authority, ER-400-7879EHS, 1981.

****** Glass, N.R. et al. "The ecological effects of atmospheric deposition." From EPA ORD Decision Series. Energy/Environmental III, EPA 600/9-78-022, 1978.

Acidic deposition also causes the deterioration of metals, exterior paints, limestone, marble, mortar, concrete, textiles and leather.* It has been estimated that such material damage in the eastern United States totals $13 billion annually.** The damage to artistic works and historic structures may be irreversible and beyond cost estimate.

The effects of acidic deposition are cumulative and insidious. Although these effects have been studied in the Northeast for more than 10 years, it is clear that the damage has been occurring for 30 to 50 years or more. The damage is being exacerbated by current high levels of SO_2 emissions in the Midwest. If emissions were reduced immediately, it would be many years before some effects were reversed. Other impacts are irreversible.

Under these circumstances, increased SO_2 emissions from Midwestern power plants, and the concommitant acceleration of damage in the Northeast, is unconscionable. And yet, such increases have been routinely approved by EPA. Indeed, EPA, is currently considering a large number of requests for increased SO_2 emission limits from Midwestern power plants. These must not be permitted.

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* Glass, N.R. "Environmental Effects of Increased Coal Utilization: Ecological effects of Gaseous Emissions from Coal Combustion" Environmental Health Perspectives 33; 249-272, 1979.

** Tschirhart (1980) cited in "A review of acid deposition in Wisconsin; Recommendations for studying and solving the problem." Prepared by the Wisconsin Department of Natural Resources Acid Deposition Task Force, 1980.

The Attorney General of New York has initiated litigation designed to prevent further SO_2 emission increases by numerous large power plants in the Midwest. Petitions have been filed with EPA pursuant to Sections 110(a)(2)(E) and 126(b) challenging proposed SIP revisions. These petitions, and EPA's response to them has been discussed by Assistant Attorney General Mary Lyndon in testimony presented to this committee at an earlier hearing in Vermont.

It is appropriate, however, to reiterate the recommendations proposed as a result of our litigation experience. Congress should order, in the Clean Air Act, immediate action to mitigate the impacts of acidic deposition. New York urges the reduction of sulfurous emissions from Midwestern power plants, without delay. The Attorney General proposes a national or regional emissions cap and/or regionally targeted sulfur dioxide rollback provision.

V. CONCLUSION

In summary, the Attorney General of New York proposes the establishment of a new National Ambient Air Quality Standard for fine particulates. The promulgation of National Emissions Standards for Hazardous Air Pollutants should be facilitated and EPA should be directed to bring all hazardous emissions under appropriate regulations without delay. Section 126, dealing with interstate pollution problems, should be clarified and strengthened. Immediate emissions reductions should be implemented to mitigate the effects of acidic precipitation. Finally, in its considerations of all sections of the Act, Congress should be guided by the mandate to provide an ample margin of protection for all of the people from all of the anticipated adverse effects of air pollutants.

The Adirondack Council
P.O. Box D-2
Elizabethtown, New York 12932
Phone: (518)873-2240

THE ADIRONDACK COUNCIL'S POSITION ON

ACID RAIN AND THE CLEAN AIR ACT

Executive Director:
Gary A. Randorf

OFFICERS
Frances Beinecke
Chairwoman
Arthur M. Crocker
Vice-Chairman
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Gene Setzer
David Sive
Breck Trautwein

July, 1981

For Further Information
Contact: Gary Randorf
518-873-2240

Over the past few decades the acidity of rainfall in the Northeast and apparently much of the U.S. and Northern Hemisphere has increased dramatically. There is little doubt that the acidity is in excess of what aquatic and terrestrial ecosystems can bear without suffering grave consequences. In the Adirondack Park of New York State (a vast six-million acre area comparable in size to the entire state of Massachusetts) almost 300 lakes have been acidified to the point of supporting little, if any, aquatic life. Additionally, reduction in the growth of forests is highly probable, and it has been learned that a number of people ar ming drinking water that is high in copper and lead, leached out estic and commercial plumbing systems by acidic water supplies. tiny sulphate particles that substantially contribute to the formation of acid rain are part of the fine particulate mass that invades human lungs to adversely affect persons with bronchial disorders and respiratory diseases. For an area so economically dependent upon tourism and the forest products industry, the outlook for the future of the Adirondacks is dim unless a permanent solution to reduce acid rain levels is forthcoming. Initial steps to control acid rain can and must be taken when the Clean Air Act is re-authorized in the coming months.

Areas like the Adirondacks, whose soils and waters have limited ability to neutralize acid and are downwind of major sources of certain air pollutants (particularly sulphur dioxide and nitrogen oxide) that contribute to the formation of acid rain are the first to be negatively affected. Over time, however, it is recognized that additional areas have and will experience acidified waters and become vulnerable to reduced forest and agricultural crop growth and be subjected to serious human health concerns.

The only permanent solution to the acid rain problem is to keep acid levels low. The only practical way to do this is to change energy use patterns--through conservation or the use of non-polluting sources--and to stop emissions at the major sources. Those from coal-burning plants can be controlled by using low-sulphur fuels, by removing the sulphur from the fuel before it is burned, and/or by "scrubbing" the gases in the smokestacks. There are several methods for controlling emissions from non-ferrous smelters.

Many scientists believe that effective controls can be applied now and they should be as we already know that sulphur and nitorgen oxides are causing extensive damage.

The only way to achieve the necessary levels of control of acid rain is to have national standards in the Clean Air Act that would establish limits on emissions from the source on old as well as new power plants, smelters, etc. Because of long-range transport of pollutants that cross state, national, and even international boundaries, it is counterproductive to try to address the acid rain problem on the state level. If the U.S. addresses the problem nationally it can then take the lead in striving internationally to achieve emission reductions in the major industrialized, polluting countries. Additionally, because of long-range transport, the construction of excessively high smokestacks should cease because this only transfers the problem to a different geographical area and is analagous to pumping raw sewage through a straight pipe to some other area and having that area deal with the problem.

How many more lakes have to die before we get the message? If we fail to act now we may achieve a more complete understanding of the acid rain phenomenon but will risk having what New York's Environmental Commissioner has referred to as the "best researched environmental disasters in history."

The environment and human health in the Adirondack Region is at stake if the Clean Air Act doesn't adequately address acid rain at a national level, and the economy of this vast area of New York State will be sacrificed for the economic benefit of states upwind, particularly in the Ohio River Valley.

If the economic burden is too great for the electrical generating facilities and other major emission sources to implement the necessary level of control then some way must be found to provide financial assistance that can be shared by all consumers, who will surely benefit by controlling acid rain now. Waiting to do something at some future time will bring disaster and a much greater cost for control.

The Adirondack Council is a coalition of four conservation organizations (National Audubon Society, Natural Resources Defense Council, Wilderness Society, Association for the Protection of the Adirondacks) and 2,000 individual members, dedicated to preserving the natural character of the Adirondack Park for present and future generations.

Adirondack Life

Editorial Office: Box 137, Keene, New York 12942 . 518/576-2270

June 22, 1981

Hon. Robert Stafford
Senator of Vermont
U. S. Senate
Washington, D. C. 20510

Dear Senator Stafford:

As the largest publication originating in the Adirondack region of New York State, we began paying attention to the problem of acid precipitation years ago, before it had attracted much national attention. We noticed first because we saw first-hand the destruction of wild lakes by this insidious, invisible menace.

The Adirondacks may lack the political leverage that goes with a large population, but because they contain much of the wildest land left east of the Mississippi, they are an irreplacable national resource of great value to present and future generations. Much the same can be said of the Boundary Waters of Minnesota, the forests of Wisconsin and Upper Michigan, and the lakes of Canada. We have destroyed so much in North America that these few remaining wild places are too precious to be priced in terms of costs and benefits. The longer corrective measures are delayed, however, the more expensive they will become. The time for action is now.

The impending reauthorization of the Clean Air Act gives Congress a clear opportunity to deal with the problem of acid precipitation. You can weaken the Act still further--"fine-tuning" it to serve the financial interests of polluters at the expense of the environment--or you can strengthen it by including standards directed at the sources of SO_2 and SO_4 emissions contributing to acid precipitation. I implore you to follow the course of environmental responsibility.

An Adirondack Life article on "The Politics of Acid Rain" (May/June 1980) put it this way:

> "Acid rain won't go away overnight," as those who are doing nothing about it tirelessly observe. On the other

hand, it might very well go away over the next decade if enough Americans decide that they don't want it. It will take tough new air-pollution laws that go way beyond the amended Clean Air Act. We have the capital and the technology. All we need is the will.

Sincerely,

Bernard R. Carman
Editor

AMC
APPALACHIAN MOUNTAIN CLUB
Mid-Atlantic Regional Office
Mountain Gate Lodge

July 1, 1981

A statement on "Acid Rain" by the Appalachian Mountain Club.

My name is Joel White, the Director of Mid-Atlantic Programs for the Appalachian Mountain Club. The AMC is a conservation and outings organization, specializing in the maintainance and operation of facilities for the pedestrian outdoor user in remote areas, including the Catskill Region of New York.

The AMC's New York Chapter has 5,000 members.

We have reviewed the documentation of the effects of acid rain in the Adirondacks and in Canada.

Our concern is for the effects of acid rain on the forests and waters which our membership and the general public use for outdoor recreation. Our concern is focused on the unknown effects of acid rain. What are the effects on our health? What are the effects on our agricultural land? What are the long term effects on forest growth?

We look to the Congress to support and appropriate funds to establish the, now unknown, effects of acid rain. We look to the Congress to take actions to deal with the problem of acid rain at its source. We look for a strong Environmental Protection Agency to be a wise steward of our environment.

As an organization , we see our role as that of an educator. We have published articles in the club's monthly "Appalachia Bullitin" to inform our membership on the issue. We have formed a clubwide acid rain working group to keep the club up

McKenley Hollow Road · Oliverea, New York 12462 · 914-254-4770

to date with the latest knowledge on the subject.

As an organization we can try, as we are today, to support legislation to understand and control acid rain, as well as, to understand and control the problem of the interstate transport of all airborne pollutants.

Thank you.

TESTIMONY

Submitted in Conjunction with the

Hearings

of the U. S. Senate Committee on Environment
and Public Works

on

Clean Air Act Oversight

Wednesday, July 1, 1981
10 a. m.

Assembly Hall, Campus Center
State University of New York at Albany
1400 Washington Ave.
Albany, N. Y.

under the chairmanship of the Hon.

Daniel Patrick Moynihan

by

Walter Goodwin, Chair
Steering Committee
Capital Area Citizens
Clean Air/Transportation
Committee
196 Morton Ave.
Albany, N. Y. 12202
(518-462-9812)

The Capital Area Citizens Clean Air/Transportation Committee is a group of residents of the Capital District of New York State who are working to promote the goals of regional planning in the Capital District, with particular attention to the needs of the region's inhabitants for adequate transportation, sensible land use, and unpolluted air. We have been monitoring the activities of the various regional planning agencies, working cooperatively with other interested organizations in the region, and speaking out when our concerns seem to be ignored by the planners and the decision-makers. We attended the July 1st hearing of the Senate Committee on Environment & Public Works on Clean Air Act Oversight, under the chairmanship that day of the Hon. Daniel Patrick Moynihan, and learned with some dismay that despite his expressed concerns with maintaining the Clean Air Act as a federal mandate to end air pollution, our Governor is prepared to dilute it in order to accomplish some questionable goals with respect to the use of coal in our energy production in this state. (These proposals were reiterated by the State's Commissioner of Environmental Conservation, Mr. Robert F. Flacke.)

Nevertheless, we heartily endorse the Governor's concern with interstate control (that is, federal regulation) of the long-range downwind effects of industrial and utility emissions, above all in the form of acid rain, dry acid fallout, and fine particulate matter. If this is not taken in hand by the federal government, all our local efforts to cut down auto emissions under our control will be offset by the influx of polluted air from elsewhere.

Secondly, the fact that the Environmental Protection Agency has been set no deadlines for coming out with regulations on air pollutants, and that so many of them are still without any sort of regulatory standards, as apparently is the case with acid rain, is shocking. We urge your Committee to write appropriate legislation to speed up this work of the EPA.

We also find that given the EPA's setting emission standards for automobiles on a volume-per-mile basis encourages the building of highways designed for more speedy traffic and the spending of huge sums on traffic intersections, rather than on alternate forms of transportation to replace the automobile, as might be the case if the EPA were more stringent in its auto emission standards.

On the other hand, without the EPA standards for clean air, our fight in the Capital District to inhibit the buildingofof shopping malls on city water supply aquifers and in fragile and rare ecosystems, to the detriment of our just-reviving downtown areas and the undermining of already-built malls, would be all the harder. Our own reasons for opposing these developments, however, is that they simply encourage further use of the automobile, since these malls cannot be conveniently reached any other way. It might be pointed out that more encompassing environmental standards on the part of the EPA would allow us to resist such undesirable development on a much broader front.

But above all, the Clean Air/Transportation Committee urges that the Committee continue its efforts to preserve the Clean Air Act and its amendments from dilution or dismemberment. There are too many threats to our well-being still wafting through our skies, dangers not yet even being dealt with by the federal Environmental Protection Agency, for us to do anything but strengthen the Act and the determination of the EPA to carry out its intentions.

Thank you.

June 27,1981

C coalition of
A adirondackers to
N neutralize
A acid
R rain
I inflow

Miners used canaries to detect the presence of deadly gases.

Dying fish in our Adirondack lakes are the "canaries in the mines," warning us of the lethal effects of acid rain.

Dear Senator Moynihan:

CANARI is a coalition of individual Adirondackers and organizations concerned with the impacts of Acid Rain on our homeland. As our representative in Washington we would like to see you actively persue passage of a strong Clean Air Act, and for additional regulation on the long range transport of acid producing sulfer and nitrogen oxides.

I am sure that at the hearing today you have heard adequate testimony on the effects of acid rain to our region. An important point to keep in mind is that if left unchecked this problem will grow in magnitude and severity. It is not so much the existing problem that disturbes us, but the specter of what lies ahead should remedial action not be immediately initiated. Our lakes, forest productivity, tourist economy and even our health eventually stand on the line.

As a Senator, and member of the Democratic party, I think that you should understand that the "mandate" given president Reagan STOPS when his administration threatens gains in environmental quality that have been made over the past decade. A recent Harris survey shows that an overwelming 86% of all Americans oppose the relaxation of existing environmental safeguards. Your constituancy is among that 86%. A look at New York State history shows that the people of this state have time and time again moved to protect their Adirondacks.

Your continuing and ever strengthening support for legislation that will protect our Adirondack Mountain lakes and forests from Acid Rain will be met with strong state wide support. The time to act is NOW.

Sincerely,

Mike Rechlin
CANARI Coordinator

June 30, 1981

Senator Daniel P. Moynihan
Chairman, Field Hearing
Energy and Public Works Committee

Dear Senator Moynihan,

I am writing to ask you to show some leadership on the Clean Air Act debate and its implications regarding acid precipitation and Canadian-American relations.

As an educator and administrator in higher education I have been following these issues closely for several years and am familiar with the current scientific understanding of the acid precipitation phenomenon and the economic implications of pressures on industry (especially the auto industry and major utilities) to deal with the matter. Moreover, during the past twenty years, I have spent an average of two months per year in southeastern Ontario in either educational or vacation contexts. I have followed the Canadian media closely on the acid precipitation issue, as well as been the beneficiary of comments and observations by numerous Canadian businessmen, educators, and farmers, who have expressed serious concern over our reluctance to deal with an issue for which solutions are perceived to exist.

I appreciate the complexity of the matter and the countervailing pressures you face. In light of these I would suggest the following to you.

1. The Reagan Administration's proposed changes (preliminary report recently released by Rep. Waxman) to the Clean Air Act eliminating specific goals and deadlines to clean up pollution in areas where the air is already dirty should not be accepted.

2. New car pollution emissions should not be relaxed at this time.

3. Federal primacy in air pollution regulation should be retained since airsheds do not correspond to state boundaries.

4. Positive incentives (through tax benefits) should be provided to existing and proposed fossil fuel burning power plants to employ the existing best available technologies to reduce sulphur dioxide emissions.

5. Existing air pollution standards should be strictly and effectively enforced, particularly in the case of chronic violators.

I personally believe that the cost of not dealing with the air pollution and acid precipitation problems at this time will increase significantly in coming years. These are real costs, in health, international relations, and the overall quality of our environment.

Compared with other problems, it seems to me that the availability of pollution control technology, the pleadings of our Canadian neighbors (I am aware of their own problems at Sudbury,), and the growing national concern over the impact of acid rain, create a climate favorable to bold action to deal with these problems at this time.

I doubt any of the above are startlingly new amid your surely growing communications on clean air and acid precipitation. However, my experience in Canada and my years in studying the issues lead me to this request for your leadership at this crucial time. Moreover, as a resident of the Adirondack Region I am acutely aware of some of the more insidious impacts of acid rain in this area.

While my suggestions will not eliminate the problem, I believe they form the basis for a measurable reduction of acid precipitation and air pollution in the years ahead.

I would be happy to help in any way I can, and I am sorry that I was not able to join you personally in Albany at the Hearing.

Please keep me posted on your views and needs on these issues.

With kind regards and best wishes,

Sincerely,

Thomas D. Harblin

Thomas D. Harblin, Ph.D.
Vice President for
Academic Affairs
Paul Smith's College
Paul Smiths, NY 12970

TDH/db

LEAGUE OF WOMEN VOTERS
OF FULTON COUNTY

141 Kingsboro Avenue
Gloversville, New York 12078
July 1, 1981

The Honorable Daniel P. Moynihan
U.S. Senate
Environment and Public Works Committee
Washington, D.C.

Dear Senator Moynihan:

In the summer of 1980 a committee of the League of Women Voters of Fulton County began a study of acid precipitation, particularly of its impact on the environment of the Adirondack region. The committee investigated the effects of acid rain on land, wildlife, plants, water and people.

We concluded that acid rain is a serious hazard to our area. For example, four lakes in Fulton County are devoid of fish and four others are in immediate danger. This, in turn, affects the wildlife available to trappers and hunters. Since our region depends heavily on tourists attracted by our outdoor recreation, this is an economic as well as an environmental concern.

We presented the results of our study to the full membership and the League of Women Voters of Fulton County emerged with a consensus of opinion.

1. Acid precipitation is a serious hazard to the environment of Fulton County and the Adirondack region.

2. Since the solution to the problem must be sought by national and even international agreements, we join and support the group known as C.A.N.A.R.I. (Coalition of Adirondackers to Neutralize Acid Rain Inflow) as the most effective way of making our concerns known to lawmakers at the state and federal levels. We also are working to inform our citizens of the dangers of acid rain by means of talks and slide presentations to schools and interested groups.

We urge that the U.S. Senate Environment and Public Works Committee take any and all steps necessary to reduce and eliminate the problem of acid rain as part of the reauthorization of the Clean Air Act.

Sincerely,
Elizabeth Holtzworth
Elizabeth W. Holtzworth
Gerda Newbower
Gerda Newbower
Co-presidents

Statement by Martin H. Pfeiffer
for U. S. Senate Environment and Public Works
Committee Hearing on Acid Rain and the Clean Air Act

My name is Martin Pfeiffer. I am an Associate Aquatic Biologist with the NYS Department of Environmental Conservation. For the past 31 years I have been involved with various aspects of fisheries management work in the Adirondack Region of northern New York State. During the past two and a half years I have been given the specific assignment of Lake Acidification Studies Project Leader in connection with the ongoing acid ion deposition problem which is exerting a negative impact on sensitive aquatic resources in vulnerable Adirondack waters.

In 1980, I co-authored a D. E. C. publication entitled: "Acidity Status of Lakes in the Adirondack Region of New York in Relation to Fish Resources". This report dealt with a subsample of 849 ponded waters which had been checked for pH and alkalinity in the 1975 to 1979 time frame. Disregarding known naturally acid ponds this report disclosed that 212 waters representing 10,460 surface acres, demonstrated "critical" summer surface pH readings below 5.0. This represented 25 percent of the numbers of waters in the subsample and 4.7 percent of the total water acreage in the subsample. Past research has indicated that pH levels during early spring snowmelt episodes are even more depressed than summer conditions. As a result, it is concluded that the great majority of these "critically" acidified ponds are no longer habitable for desirable forms of fish life, such as self-reproducing brook trout. This has been confirmed by test-netting checks on a significant subsample of these waters.

Because the numbers and percentages of "critically" acidified ponds have been quoted and misquoted in various articles and reports, I feel it is desirable to set the record straight, since most of the writers have not made it clear that these figures only allude to a subsample of available Adirondack ponded waters. Based on the 1980 update of "acidity status", again disregarding naturally acid ponds, it was estimated that 190 ponds, representing 9,910 acres were in a "critical" state of acidification. The reduction in the "critical" category reflected improved water quality resulting from a notable lack of precipitation. In other words, following a winter with minimal snow pack some ponds that were formerly in a "critical" condition moved up to the "endangered" category which represents a range of 5.0 to 6.0 on the pH scale. We have adopted the policy of classifying "acidity status" on the most recent chemical analysis.

The resource inventory section of the aforementioned acidity status report revealed that the Adirondack Ecological Zone contained 2,877 individual ponded waters representing a total surface acreage of 282,154. When we extrapolate the updated 1980 subsample of critically acidified waters to the total available resource we develop an estimate of 583 waters, representing 11,483 acres. Since the Acidity Status report demonstrated an inverse correlation between the size of a body of water and its proneness to "critical" acidification the figures we have generated are presumed to be minimal. This is due to the fact that the average size of the remaining bodies of water which have not been studied is less than 30 acres.

At our current modest rate of investigative effort it will take 20 years to gain a complete understanding of the magnitude of the acidification problem in regard to its total impact on the Adirondack ponded water resource. The Bureau of Fisheries has prepared a proposal for greatly expanded Adirondack acidification studies to accomplish the task in an accellerated five year time frame. Expanding the current acid waters efforts to the levels suggested will provide complete and up-to-date information urgently needed to understand and react to this serious environmental problem.

CLEAN AIR ACT OVERSIGHT

WEDNESDAY, JULY 1, 1981

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
Fairbanks, Alaska.

OPENING STATEMENT OF HON. FRANK MURKOWSKI, U.S. SENATOR FROM THE STATE OF ALASKA

Senator MURKOWSKI. Welcome to the Environment and Public Works Committee oversight hearings on the 1977 Clean Air Act. I have with me today on my right and your left Mr. Jon Jewett, associate counsel for the majority, Environment and Public Works Committee. Jon has been involved in this issue in both the House and Senate and brings to our group a great deal of expertise in the area of the Clean Air Act and more particularly its interpretation.

I have on my left a member my staff, Legislative Assistant Mr. Jon DeVore, who keeps me informed on the workings of the activities associated with the full Committee on Environment and Public Works and has been spending most of his time in the area of the Clean Air Act in view of the fact that the entire Environment and Public Works Committee sits as a whole on the Clean Air Act, which is up for renewal at this time.

We will try and accommodate those of you who have planes to catch. However, we are going to open with the community leaders who have indicated that they will be presenting testimony. Before I call on the witnesses I have a brief opening statement.

The committee has now completed several days of hearings in Washington, D.C., Vermont, New York, and Seattle, Wash.; I participated with Senator Slade Gorton in a hearing in Seattle last Saturday. And now we're in Alaska to hear firsthand the experiences that Alaskans have had under the act. We are very anxious to hear your comments. And you can be assured that we will take your thoughts back with us to Washington and they will become an important part of the committee deliberations.

I might add that some of you may feel that you were not given enough time and notice on this particular hearing, and for that we apologize. However, the committee, under the direction of the Senator from Vermont, Bob Stafford, and staff indicated that it would be in the best interest to try and expedite these hearings which we had originally hoped to schedule for August. So, as a consequence, we moved them up and we do apologize for the lack of notice.

We do not come to this hearing with any preconceived notions nor predetermined positions. We are here to listen to your views, to learn from your experience, and to gain enough information to resolve Alaska's problems carefully, thoughtfully, and systematically. As a new Senator on the Environment Committee, I've come to realize how complicated this issue can be. I know that there's no easy answer or magic solution. Those answers will come only with hard work and knowledge. But I also know that certain aspects of our national clean air program are not working as well as they should. But I'm not sure whether the problems are the result of the law itself or if the problems result from the inflexibility of the regulations.

The major deficiency in the current act is not the severity or laxity of its standards, but the lack of a clear delineation of its functions between Federal and State governments and lack of built-in flexibility for the States to target their resources toward the most serious local problems. The programs included in the act do not always work effectively together to achieve and maintain clean air.

Alaska's position flows from a desire to maintain standards but at the same time to improve the process for implementing the requirements of the act. I can't overemphasize that in all the testimony given at the Seattle hearing, the major theme that came through was the complexity of the act itself. And it seems like there is overreaction perhaps in the minds of some of my constituents as we approach this subject; and I think it's an extreme one; and it represents part of the problem and what we're going to have to overcome to make improvements and learn how to live within the requirements of the act. From the standpoint of the developer, his general attitude when we approach this subject is one of eagerness because he has to work with the complexities of the act and is looking for any change that would make it easier to work with. On the other hand, the environmentalist is often uncomfortable when we approach it because he sees the potential for a relaxation in the standards. And this is part of the problem that we are confronted with and what we're going to have to relate to.

Obviously the two alternatives are to approach the act by changing the legislation or going along with the act and trying to make it simpler through flexible implementation.

We will begin todays hearing with the elected officials followed by the Governor's representative, who will give us an overview of the State of Alaska's position. Then we will move into a series of specific issues. The first panel will focus on mobile source emissions, which during the cold months of the year are the source of our State's most serious pollution problem, carbon monoxide. Dangerously high levels have been found in Anchorage and here in Fairbanks in certain locations. And I believe, as most of you do, that we must do something about it.

Our panel consists of city officials, environmental experts, and university scientists, all of whom have given serious thought to the problem. We will then turn to the prevention of significant deterioration program, or PSD, which is intended to preserve Alaska's clean air but which often appears too complicated and unwieldy and not terribly efficient. For that discussion our panel includes major industries, local government, and environmental groups.

Our third panel will delve into new source performance standards, which under the law and subsequent regulations requires that all coal-fired powerplants install scrubbers regardless of the sulfur content of the coal. Our panel for that subject includes coal producers, utilities, representatives of the petrochemical industry, and again, knowledgeable environmental groups.

Our final panel will discuss implementation issues including compliance and enforcement to help understand some specific problems. There our panel includes timber and pulp company representatives, and of course, public interest groups.

We will conclude today's hearing with an open session, taking statements from the floor for as long as time permits. We do not plan to break for lunch. Hopefully, we'll be through by 1:30 or 2. If you wish to make a statement on the Clean Air Act or a clean air issue, please be sure to sign the register by the door. I also would ask that all witnesses identify themselves for the record when giving their testimony.

We have strived in assembling this hearing to bring together knowledgeable Alaskans in a spirit of learning together. I feel we have done that, and I look forward to hearing from you at this time. And it's particularly a pleasure to hold the first hearing, and probably the only hearing that will be held in Alaska, here in Fairbanks.

The first witness will be Mr. Richard Joy representing Mayor Carlson and the Fairbanks North Star Borough. Incidentally, we generally run about a 10-minute presentation period, which is usually adequate. If you have something longer, why you can go ahead. We probably have sufficient time to accommodate you. But I would assure you that a full statement will be included in the record. And the record will be kept open for at least 2 weeks. So those of you who may wish to submit a statement for the record after this hearing may do so, or anyone else that you may come in contact with that would like to submit something for the record, it will be open for 2 weeks. Mr. Richard Joy, welcome to the committee and good morning.

STATEMENT OF RICHARD JOY, ENVIRONMENTAL ENGINEER, FAIRBANKS NORTH STAR BOROUGH

Mr. Joy. Good morning, gentlemen. My name's Richard Joy and I'm presenting this testimony as environmental engineer for the Fairbanks North Star Borough. The urban areas of the Fairbanks North Star Borough are presently designated as being in nonattainment for carbon monoxide. The borough, as the lead planning agency, is currently developing a plan which will hopefully allow this area to attain the standard by 1986. My testimony will therefore mainly cover those provisions of the Clean Air Act which impact our attainment planning process.

As part of its review of the Clean Air Act the National Commission on Air Quality has recommended that the carbon monoxide emission standard for new light-duty vehicles and trucks not be lowered to 3.4 grams per mile as is currently required in the law but rather remain at the present level of 7 grams per mile.

The proposed relaxation of this emission standard will seriously hamper the progress toward attainment of the carbon monoxide standard in the Fairbanks area. In order to achieve the reduction from 7 to 3.4 grams per mile the automobile manufacturers are concentrating on reducing the large quantity of emissions produced during the first few minutes of vehicle operation after startup; in other words, the cold-start emissions. Because such emissions produce the majority of the carbon monoxide emitted into the ambient air of the Fairbanks area any deemphasis on reduction of these emissions will greatly increase the difficulty of ever achieving attainment in this area.

Also, because light-duty trucks make up over 40 percent of the total vehicle population in the Fairbanks area, any loosening of just the light-duty truck emission standard will still seriously hinder attainment in this area.

Due to the possibility that an inspection and maintenance program may not be very effective in reducing cold-start emissions, we recommend that such a program be made elective, rather than mandatory, for those areas which are granted attainment extension dates to 1987. The attainment planning process is designed to give individual localities the opportunity to pick those strategies which are best for their areas. To mandate one certain strategy subverts this entire process.

The Alaska Department of Environmental Conservation, is currently conducting research to determine the effectiveness of an inspection and maintenance program on reducing cold-start emissions. Making this program elective will give Fairbanks, Anchorage, and possibly other communities the option of selecting an I/M program based on the results of that research.

As part of the plan requirements for nonattainment areas the Clean Air Act specifies that new or modified stationary sources which are located in such an area must comply with the lowest achievable emission rate. Such as specification totally ignores any consideration of cost effectiveness and is a step beyond the best available control technology required under the prevention of significant deterioration legislation. With best available control technology the permitting authority is allowed to take into account energy, environmental, and economic impacts and costs in determining the required control technology. Under new source performance standards the permitting agency is also allowed to take into consideration the cost of achieving such emission reductions, and any environmental impact and energy requirements.

It is our recommendation that the lowest achievable emission rate be replaced with a control technology specification that allows consideration of cost effectiveness. It is very apparent in the Fairbanks area, where over 95 percent of the carbon monoxide emitted is generated by motor vehicles, that requiring stationary sources to install very expensive control equipment to reduce carbon monoxide emissions would not be cost effective. Such a requirement would be imposed upon the Fairbanks Municipal Utilities System's proposed powerplant expansion although no significant difference would be noticeable in ambient ground-level carbon monoxide concentrations due to the imposition of lowest available emission rate. It should be left up to the permitting agency, taking all impacts and costs into consideration, to determine the requisite control technology.

Another area of the Clean Air Act which affects the proposed MUS powerplant expansion is the prevention of significant deterioration requirements. Under the PSD requirements a new stationary source, similar to the MUS facility, could produce up to 250 tons per year of particulates before a PSD review would be required. However, any modification of the MUS plant which resulted in an additional 25 tons per year of particulates would have to undergo PSD review.

This inequity resulted because the Clean Air Act does not contain an exact definition of a "modification" to an existing stationary source. The Environmental Protection Agency therefore promulgated regulations to clarify this definition and specified that, for particulate emissions, any additional increment of more than 25 tons per year must undergo PSD review. It is our suggestion that an exact definition of a "modification" be included in the act which specifies that a source can be modified to allow pollutant emissions resulting from that modification of up to the threshold limit for PSD review of a new source—in other words, for particulates this would be 250 tons per year—before PSD review of the modification is required. This would make the review requirements the same for both new sources and modification of existing sources.

This concludes my testimony. Thank you for your time.

Senator MURKOWSKI. Thank you, Mr. Joy. I have some questions. It's my understanding that under the act by 1982 there's required inspection of automobiles. Is that basically correct? In nonattainment areas, of which Fairbanks is one.

Mr. JOY. It's correct for communities of over 200,000.

Senator MURKOWSKI. Of over 200,000.

Mr. JOY. Fairbanks does not fall under that category.

Senator MURKOWSKI. Your contention was that it's not practical that that be applied here in Fairbanks and it wouldn't necessarily be cost effective. I'm curious to know why it wouldn't necessarily be helpful to require mandatory vehicle inspection to make sure that the catalytic exhaust systems were operating functionally. If it's practical in warmer climates why necessarily wouldn't it be practical here?

Mr. JOY. At this time, limited research in the Fairbanks area has shown that an inspection maintenance program probably does not do much to reduce cold-start emissions. And that's the object of a very intensive DEC research effort, which I'm sure they'll go into. But because of the possibility that it does not reduce cold-start emissions that much, and because of the large effect of cold-start emissions in the area, it may be that inspection maintenance will not have that much effect on total emissions into the Fairbanks air.

Senator MURKOWSKI. So you attribute it to the unique situation here. The severe cold weather where even if the vehicles were operating properly within the designed efficiencies, you still would not overcome the problem of the cold-start carbon monoxide emissions?

Mr. JOY. That's true. Both Anchorage and Fairbanks, although Fairbanks, of course, more so, have a large portion of their emissions from cold-start. The idle tests required under the inspection maintenance program appears not to be effective in reducing cold-start emissions.

Senator MURKOWSKI. Do you have any knowledge of new technology that might be applicable in specifically addressing this problem that's somewhat unique to the Anchorage-Fairbanks areas?

Mr. JOY. I think I should probably let DEC go into that in more detail. They're more knowledgeable than I am about that.

Senator MURKOWSKI. DC?

Mr. JOY. DEC, the department of environmental conservation.

Senator MURKOWSKI. Oh, OK. You know of nothing to indicate that locally anybody's giving particular attention to the problem. I think it's obvious to us all, if the problem is in the cold-starts and we know it is, and the emissions that occur at that time, and the automobile technology as designed functioning properly still does not correct it, then the question is how do we get there from here.

Mr. JOY. Well, we're looking at a number of strategies to try to attain the standard. A couple of them that do do something about cold-starts are plugging in a vehicle, which everyone does anyway. But it appears that keeping a vehicle engine warm will reduce the cold-start emissions to some extent. The possibility that some of the new technologies that the car manufacturers are coming out with will reduce them is very apparent, too, because that's what their working on right now to get from 7 grams to 3.4 grams; they're working on the cold-start. It appears with the limited data that's available so far that some of the new cars do have substantially lower cold-start emissions. But that is exactly why we need to make the program elective, to find out if that's true or not. If we make it mandatory and we find out that it is not true, then we're stuck with a program which could be very expensive to implement and doesn't give us a very great benefit. But if it's made such that we can determine after the research is done that the program is effective, then we can always pick it up.

Senator MURKOWSKI. Do you have any conclusive evidence to support the theory that we'd be better off if we left the cars running, in spite of the cost of gasoline?

Mr. JOY. That's been looked at, but I would say it's so dependent on temperature and a number of other operating conditions that it's not conclusive one way or the other. If the cars were left running all day, it would probably create more emissions than during just the cold-starts. But no one has done an indepth study of that.

Senator MURKOWSKI. Does your department accept the responsibility or what agency is responsible, in the situation where you get a high concentration of carbon monoxide over an extended period of time of ice fog conditions, to set up an alternative traffic flow or some type of an alert system?

Mr. JOY. Our agency is responsible for an emergency episode plan, and we have one in the Fairbanks area, which the last time we implemented was a couple of years ago because our concentrations have been falling steadily.

Senator MURKOWSKI. What do you attribute this falling to, is it a rundown after the pipeline activity?

Mr. JOY. It's about three different things. One of them is the turndown after the pipeline. Another is the use of smaller engine vehicles due to the gas crisis. It appears that cold-start emissions are fairly proportional to engine size. And so the smaller the car engine, the less emissions you have per start. And then, of course, the gas crisis is causing people to drive less and buy the smaller engines.

Senator MURKOWSKI. It's my understanding that section 233 of the Clean Air Act precludes any State from regulating aircraft emissions; they're regulated directly by EPA in consultation with the Secretary of Transportation. I know that there's been a good deal of concern expressed in the community with regard to the increased activity at the Fairbanks International Airport, particularly with the introduction of a number of 747's which exacerbate the ice, fog, CO_2, and some of the other high moisture components that add to the ice fog concentration of the area. Do you have any comments or concern or information concerning that, and how much of a problem it is at this time?

Mr. JOY. We've looked at the emissions generated by aircraft activity out at the airport, and they're very minimal in terms of carbon monoxide concentrations compared to the automobile.

Senator MURKOWSKI. So they don't present a health hazard, just an inconvenience, is that what you're saying?

Mr. JOY. That's correct. They do produce some ice fog increase, but for carbon monoxide, there's not much of an increase especially at ground level where the concentrations concern us. The engine may produce quite a bit of carbon monoxide up higher, but it's not going to come down with our inversions. It'll stay up off the ground and won't be a hazard to human health.

Senator MURKOWSKI. Another question. Perhaps you could provide an update for the committee because there was some concern expressed previously about the Fairbanks Municipal Utilities System expansion of the steamplant to serve and move into some of the subdivisions; but the consequence of burning more coal which, of course, would be necessary and the ability to stay within the parameters of the act, has that been resolved totally?

Mr. JOY. It hasn't been resolved totally yet. It's possible that they could get a permit. It's not impossible. However, they would probably have to install expensive control equipment. For carbon monoxide, for example, they would have to achieve the lowest achievable emission rate. And that means finding whatever in the United States is most recent, up-to-date control equipment available on that type of coal-fired plant to reduce carbon monoxide. Although such emissions would be very minimal compared to the emissions from the automobile; and therefore, that would be expensive. Also, PSD requirements are very expensive, and they would have to satisfy those for particulates.

Senator MURKOWSKI. What is the city doing about this dilemma?

Mr. JOY. Right now I'm not sure. They're talking to the department of environmental conservation who is the permitting agency for their air quality permit. And I'm not sure what the latest status of those talks are.

Senator MURKOWSKI. Well, is it the consensus of the MUS or the general attitude of the city that by extending the steam services, they're actually reducing the amount of pollutants that would go into the air because the conversion of these homes offsets the expansion of the steam plant to generate the necessary steam?

Mr. **Joy**. Yes, I think economies of scale being what they are, it would definitely be a reduction in pollution to take away all the individual sources from individual homes and concentrating them in one spot where they can be controlled.

Senator **Murkowski**. But the problem you run up against is under PSD—prevention of significant deterioration—as required by the act you may be precluded from doing this, even though it's my understanding that Alaska coal has substantially less sulfur than east coast coal. What are the numbers—is it 2.5 percent sulfur in the coal?

Mr. **Jewett**. For Alaska coal, 0.25 percent and below.

Senator **Murkowski**. For Alaska 0.25?

Mr. **Jewett**. Yes, and I think that it is more like 2 to 3 percent and above in the East.

Senator **Murkowski**. And it's 2 to 3 percent for the eastern seaboard coal.

Mr. **Joy**. Yes, that's correct.

Senator **Murkowski**. The point I'm trying to make is we've got a situation here where even though we have coal that has less sulfur, still under the interpretation of the act and particularly PSD, that cannot be taken into account.

Mr. **Joy**. That's correct. Under the act there are no considerations given to individual situations; and they're required to install that kind of equipment whether or not the emissions are low or not.

Senator **Murkowski**. It would be very helpful if we had a statement for the record from the MUS as to the current status of this particular situation, because I think it represents a good interpretation of how uniformity is not necessarily desirable or consistent with what we're trying to achieve; and that's basically cleaner air and less pollution in the air. I think there's a reasonable case that can be made for the argument that it would be in the best interest, particularly of the downtown area, to have an expansion of the homes utilizing the steam system rather than continuing with an individual oil burner or whatever in each individual home, which points out that if there were some flexibility, undoubtedly we could achieve the objective which is for cleaner air yet still live within the intent of the law if there were some provision included in the redrafting that would cover cases like this. I have no further questions. I thank you for your testimony. And again, I would express the request that if you would be kind enough to bring us for the record in the next 2 weeks a letter as to the status of this proposal it would be helpful.

Mr. **Joy**. Thank you.

Senator **Murkowski**. Thank you very much.

We have Ernie Mueller with us today, commissioner, department of environmental conservation. Ernie's got his blue book with him. Good morning and welcome to the hearing. We very much appreciate your taking the time from your busy schedule to be with us, Ernie.

Mr. **Mueller**. I'm never too busy to talk about the Clean Air Act, Senator.

Senator **Murkowski**. Well, I'm sure you've been living with it for a long time. Do you understand it?

Mr. **Mueller**. No.

Senator **Murkowski**. OK.

Mr. **Mueller**. I have some people who think they understand part of it.

Senator **Murkowski**. Well, I've never heard an honest man say he understood it. All of it, at least.

STATEMENT OF ERNST W. MUELLER, COMMISSIONER, DEPARTMENT OF ENVIRONMENTAL CONSERVATION, STATE OF ALASKA

Mr. **Mueller**. Mr. Chairman, for the record I'm Ernst Mueller, Commissioner of Environmental Conservation for the State of Alaska. And I'm here today representing Governor Hammond who wishes to express his appreciation to you and to the entire Committee on Environment and Public Works for holding this hearing in our State.

To many in our Nation, Alaska seems a faraway place with clean and unthreatened air and water. I am sure that to many Americans unfamiliar with Alaska, the concept that air pollution could be a problem in Alaska is beyond belief. The truth, of course, is that air quality in Alaska's two largest cities does not meet the State and National ambient air quality standards to protect the public health from the adverse effects of exposure to carbon monoxide.

Fairbanks is a particularly appropriate location for this hearing, as it was the first city in Alaska to demonstrate concentrations of this air pollutant substantially in excess of the State and national standards. Through the programs established under the Clean Air Act and State and local law, the carbon monoxide concentrations in Fairbanks' air have steadily declined for over 6 years. We want to make sure that any amendments to the Clean Air Act maintain this strong momentum toward finally meeting the air quality standards in Fairbanks.

The Clean Air Act has established a number of programs designed to protect the public health and welfare, and control or reduce emissions of air pollutants from industrial activities and automobiles. Today, I wish to comment on four of these programs as they affect Alaska.

Earlier mentioned was the national ambient air quality standards program that were a major element of the 1970 Clean Air Act amendments. The U.S. Environmental Protection Agency was directed to establish standards to protect the public from exposure to harmful concentrations of the more common air pollutants with a margin of safety. Each State was required to develop its own individual plans, the so-called State implementation plan, to assure that air quality remains better than these standards and to remedy situations where pollutant concentrations exceed them.

Fortunately, Alaska has extremely high air quality except for those concentrations of carbon monoxide during the winter in Anchorage and Fairbanks that I mentioned earlier. In 1972 the Alaska Department of Environmental Conservation developed regulations to limit emissions of particulate matter and sulfur dioxide from fuel burning equipment at electrical utilities and industrial facilities, from incinerators and from a number of specific industrial processes. An ambient air quality monitoring network was established to determine pollutant concentrations near major complexes of industrial activity. About 50 facilities exceeded the emission limits that we imposed and most were able to take corrective action to comply with these standards within 2 to 5 years, often with improvements in air efficiency or operations.

Anchorage and Fairbanks have established their own environmental programs, and you heard from Richard Joy of the Fairbanks North Star Borough that has established its own air quality control program, to study and solve their carbon monoxide nonattainment situations and other air quality problems in those boroughs. After extensive research and planning these local agencies are completing the design of complex transportation control strategies which should bring about the attainment of healthful air quality by 1987, the final deadline in the current Clean Air Act.

The department of environmental conservation and the Environmental Protection Agency were able to determine that particulate matter concentrations that were found in excess in some areas in the early 1970's were primarily due to windblown dust—the greater part of which is not respirable and not considered a probable health hazard.

The 1977 Clean Air Act amendments reaffirmed the national goal of protecting the health of people, especially the susceptible members of our society from the ill-effects of air pollution. In Alaska, our department has worked with the municipality of Anchorage, the Fairbanks North Star Borough, and the industrial sector of our State to meet and sustain this goal.

We recommend that the concept of setting health-related primary ambient air quality standards based on the protection of the health of susceptible individuals in our society with a margin of safety be retained in the act. Congress should also reemphasize the need for the U.S. Environmental Protection Agency to fulfill the current requirement contained in the 1977 amendments to develop a respirable fine particulate matter standard so that we can define the difference between what parts of the particulate matter are a health problem and what are not and we then can go on about controlling those air pollutants in that particular area that do create a health problem rather than control something that does not.

A second feature of the 1970 amendments was the establishment of new source performance standards and hazardous air pollutant standards programs. Congress directed EPA to establish specific pollutant emission limitations for major classes of large new sources, as the Agency determined which source classes were of national concern or impact, and the control technology became cost-effective.

This program has been generally quite effective in encouraging the development and application of new technologies to reduce pollutant emissions from many categories of new sources, many of which are found in Alaska; oil refineries, asphalt plants, utility boilers, and turbines.

The 1977 amendments, as was mentioned earlier, included a requirement that all new large coal-fired utility boilers must install flue gas sulfur dioxide removal systems. This requirement is *imposed regardless of the quality of the coal, the final sulfur dioxide concentration in the stack exhaust, the existing ambient air quality, or other environmental impacts.*

We recommend that the Federal Government continue setting cost-effective technological standards for the control of emissions from classes of major new sources, but the act should define a major new source as one which emits more than 250 tons per year of the pollutant to be regulated. In the case of hazardous air pollutants, however, we feel that no minimum potential emission rate should be set. EPA and the States should continue to limit or eliminate emissions of hazardous pollutants regardless of source size.

We recommend that the mandatory requirement for sulfur dioxide removal be eliminated for boilers burning coal with less than one-half percent sulfur content, the Alaskan coal you referred to earlier. And I'm sure you'll hear more from that from the electric power industry later today. We feel that it should be the State's responsibility; the State should be free to determine what sulfur dioxide removal techniques, if any, would be necessary to properly manage air quality.

A third requirement of the 1970 and 1977 amendments were deadlines by which control programs for areas in which air quality exceeded the health related standards must attain those standards. For those areas which exceed the carbon monoxide or ozone standards, a vehicular inspection and maintenance program as designed by EPA was required to be included as part of the control strategy, if the attainment deadlines were extended to 1987.

Both Anchorage and Fairbanks will be unable to demonstrate attainment with the carbon monoxide standard by 1982 and were granted an extension to 1987. The two local agencies, in combination with the State and EPA, have developed programs which include 12 to 13 different strategy elements to reach attainment, lots of different means by which we can eventually reach the goals in the Clean Air Act. Research in Anchorage and Fairbanks indicates that in winter the majority of the carbon monoxide is emitted from vehicles during startup, while the inspection maintenance program is designed to minimize emissions from a warmed-up vehicle traveling the highway. Thus, implementation of an inspection and maintenance program may not achieve the emissions reductions anticipated by the law.

The Alaska Department of Environmental Conservation and the Alaska Department of Transportation and Public Facilities have recently agreed to conduct an extensive 2-year research program in Fairbanks utilizing a sophisticated mobile emission testing facility built by the Environmental Protection Agency's Enforcement Division in Ann Arbor, Mich., and shipped to Fairbanks this spring. This research will determine the emission from vehicles operated during the cold Alaskan winter conditions and the effectiveness of several emission reduction schemes including the standard inspection and maintenance program. This study will cost nearly $1 million and is designed to help determine the most cost-effective way to achieve healthful air quality for the citizens of our two major cities as soon as feasible.

We recommend that the act continue to retain deadlines for attainment with health-related standards to encourage Government agencies, including our own, industries and individual citizens to work together to reach the goal of healthful air quality. However, we recommend and agree with the borough that the inspection and maintenance program not be specifically required as a strategy, but be listed as one of the several control strategy options which a State or local agency may select for its attainment plan. After all, our goal should be to reach clean air, not to have necessarily an inspection and maintenance program.

The 1977 Clean Air Act amendments created a new program to protect air quality where it is considerably better than the national standards as is the case in most of Alaska. Incremental increases of pollutants caused by industrial development are allowed, but special protection is provided for national parks and most wilderness areas that existed at the time; that is, 1977. New pollutant emitting facilities are required to apply the best control technology available for each pollutant emitted.

This so-called prevention of significant deterioration program also requires the use of sophisticated computer techniques to predict changes in air quality. Many locations in Alaska where future industrial activity will occur are very complex in topography, and data to describe the correspondingly complex meteorological conditions does not exist. In such cases the computer modeling necessary to predict the impact of a new facility may be extremely difficult and costly. The regulations developed by EPA to implement this program have become very complicated, very confusing, and quite controversial. However, the basic elements of the program, air quality increments, best available control technology, and air quality impact analyses, are very useful tools for the management of both air quality resources and industrial development.

Since the 1977 amendments 10 activities in Alaska have undergone prevention of significant deterioration review. None of these projects were substantially delayed by that review, and none of them were canceled because the facility could not meet the requirements. These reviews included development of the Prudhoe Bay oil field, expansion of the Alyeska pipeline throughout capacity, expansion of the Tesoro Refinery on the Kenai, the Alpetco Refinery project at Valdez, the Alaska natural gas pipeline project, and a number of smaller activities.

We recommend that the prevention of significant deterioration of air quality program be retained as the primary national air quality management system. The regulations and requirements must be simplified and streamlined, however; the technology standards and review requirements must be made uniform and consistent with other Clean Air Act programs.

Specifically, the increment system should be retained to prevent significant adverse changes in air quality. Rather than eliminate this management tool as many have proposed, we recommended that it be improved by, for example, utilizing a quarterly or season increment rather than predicting the fleeting short-term incidents or annual estimates of small changes in air quality.

The act should specify that both the new facility and the old facility which undergoes modification or expansion are subject to these review requirements, when total emissions, after applying the appropriate emissions controls, increase by the amount currently indicated in the act. I got—we're asking there for a definition of the modification, as was mentioned in Mr. Joy's testimony. This would remove the inequity that currently exists where by several existing facilities in Alsaska would be required to undergo review for increases in emissions of only 10 to 16 percent those allowed to a comparable new facility.

In summary, we believed that the Clean Air Act program should be retained. The major deficiency is neither the severity nor the laxity of its standards, but lies in the complexity of the programs and the lack of a clear delineation of functions between the Federal and State governments. The programs included in the act and implemented in regulations of the Environmental Protection Agency do not always work together effectively to achieve and maintain clean air. Our position flows from a desire to maintain standards while we seek to improve the processes for implementing the requirements and attain in the goals of the act.

Thank you for the opportunity to present our comments. I and my staff look forward to working with you and the staff of the committee in preparing the final amendments to the Clean Air Act that you'll consider. I have copies of my testimony available for you.

Senator MURKOWSKI. Thank you, Commissioner Mueller. We would like very much to have those. John, if you'd be kind enough to be sure that we pick those up from the commissioner. I certainly want to thank you and Governor Hammond for your outstanding testimony. I think it points out, certainly for me, the situation with regard to Alaska. In your testimony you indicated that you felt the sulfur dioxide emission control generated from coal burning should be something that the State should have conrol over, basically, because I assume you contend that the State has a good case to make, first of all, based on the low sulfur of the coal. However, I'm sure you can readily understand the difficulty the committee has when other States will point out that this is not a State problem; it should be a Federal problem as pointed out by the acid rain situation in certain areas of eastern Canada that have to be dealt with on a Federal basis.

Also your statement with regard to auto emissions is another one that many States would take issue with. We do have the problem, it's a peculiar problem in Alaska. Most States seem to indicate that the only way to control vehicular emissions is through Federal legislation. So it does point out the peculiarity of Alaska, and I guess it's something we've all learned to live with and are going to have to accept.

I have a few other questions. If new cars are required to meet a 7-gram-per-mile rather than a 3.4-gram standard, will this prevent or only delay the attainment of the CO_2 standard in Anchorage and Fairbanks?

Mr. MUELLER. We haven't done the complex analysis needed to completely answer that question. Our strategy, as exists, was developed on the 3.4-gram-per-mile standard. The National Commission on Air Quality claims that leaving the standard at 7 grams per mile is not going to change the amount of carbon monoxide that is emitted into the air in a particular driving cycle; and I'm not sure that they've convinced anybody but themselves on that one.

When I met with them in Seattle a couple of months ago that's what they said; and most people were saying that simply doesn't make any sense. I think that the air quality in Fairbanks will continue to improve, at least in a short term, regardless of what is done with the vehicle standards.

Senator **MURKOWSKI**. You attribute the substantial improvement in Faribanks to, what, smaller automobiles?

Mr. **MUELLER**. Well, over the last at least 6 and probably 8 years, we've noticed a steady decrease in the number of days that exceed the national primary standard in Fairbanks and the size of that exceedence. And that's due, I think, to a large number of factors—some of which we have no control over, but one of which is that there's been a substantial amount of traffic rerouting in the Fairbanks area. There's been a large number of new roads built. Maybe that just dispersed out the pollution and so now we're ending up with finding exceedences over the standrds in some of the areas we didn't find them before. But they're not as large; there aren't as many.

Senator **MURKOWSKI**. In both Fairbanks and Anchorage it's my understanding that there are specific locations where we have the problems. I think in Anchorage Northern Lights Boulevard and Minnesota Avenue are areas of high concentration.

Mr. **MUELLER**. Right, there's some hot spots out there; that's right.

Senator **MURKOWSKI**. I assume it's pretty difficult to reroute much traffic on those crucial thouroughfares.

Mr. **MUELLER**. Well, but what is happening in Anchorage and Fairbanks is that—now in Anchorage more than Fairbanks because Fairbanks started earlier on major road construction—is that when major highways are designed, we can design them to take out some of these problems; to make the traffic move faster, to move more smoothly, and to do some stoplight operation design, parking management, and that sort of thing to help alleviate the problem. Fairbanks started earlier on that with some of its road and bridge construction in the early 1970's. Anchorage, only in the last few years, has started some major highway construction. So I think we've noticed a decrease which can be attributable partly to that in Fairbanks before we'll notice such a decrease in Anchorage. There's a lot of one-way street reassignments in Fairbanks in the early 1970's that I think help.

Then tied on with that is the general decline in grams per mile by all vehicles as a result of the Federal program. And also, even if people are not driving less, they are driving smaller cars; they are driving more energy efficient cars and as Dick said, they warm up faster so you don't end up with a cold start phenomena for quite as long.

Senator **MURKOWSKI**. Does the State intend to reclassify any of its PSD class II areas as class I areas?

Mr. **MUELLER**. Not at this time.

Senator **MURKOWSKI**. If the class II and class III increments were made optional, would Alaska continue to use the increments?

Mr. MUELLER. That would be our intention, we might change the size of those increments.

Senator MURKOWSKI. Has the State drafted a State implementation plan; and what is the status of the State's plan at this time?

Mr. MUELLER. The portion of the State plan that refers to mobile sources has been approved by EPA. The portion of the State plan which refers to stationary sources, the control which would allow us to assume the management of the PSD review program, the new source performance standards review, the emission standards for hazardous air pollutants, we are still negotiating with EPA over that and we have been for 2 years. And I think we're not to the point where we can get it approved.

Senator MURKOWSKI. It is my understanding that as a consequence of the Alaska land claims legislation all the parks and refuges will automatically be included in class I areas. Is that correct or incorrect?

Mr. MUELLER. No, that's not correct. When the Clean Air Act was pased in 1977, at that time, of course, the Alaskan National Interest Lands Acts of various types were being considered. And we were very concerned that the mandatory inclusion of all national parks and wilderness areas in class I would have a devastating effect on Alaska. And we worked very hard with the Senate to make sure that that applied only to existing national parks and wilderness areas. So we only have the three refuges that were wilderness areas at that time, and Mount McKinley National Park as class I in Alaska today. And it's not our intention to reclassify any of the—at least at this time—reservations that were made as a result of the Alaska National Interest Lands Act to class I.

Senator MURKOWSKI. A question that had come up some time ago and I was exposed to at the Seattle hearing by the testimony from the U.S. Park Service, concerned the designation of integral vistas from within national parks. It occurred to me that we had a situation some time ago concerning an expansion of the Healy Power Plant. I'm curious to know if you're familiar with whether the vista principle applied to that proposal, which I gather has been abandoned by the local municipal utility—or excuse me, I guess it was Golden Valley Electric—because of the cost associated with putting in the plant on one hand, and on the other the interpretation that under the Clean Air Act that it was too near a national park and consequently permits would basically be nonachievable. Can you recall if this integral vista concept has any application to this particular program?

Mr. MUELLER. Well, the Golden Valley people are here and I'm sure will discuss that with you. At the time that that particular plan expansion proposal was abandoned, it was my understanding that it was largely due to economic reasons but it may have been partly—just a number of straws on the camel's back, one of which may have been this one. But I do know that the interpretation—at least in my view—the interpretation of EPA of the visibility protection portion of the Clean Air Act is quite different than what I thought it was going to be when it passed in 1977. Our feeling was we should protect Mount McKinley from the air surrounding it being so dirty that you can't see it and from the mist or particulates in the air detracting from the view of Mount McKinley. Their final regulations turned that around and said well, you can't see any plumes of powerplants from inside the national park. And I think that is exactly the opposite of what at least our understanding of that particular portion of the Clean Air Act was. And I think that's typical of a lot of the problems that we have had with the national program for managing air quality; that is, the Clean Air Act looks like—if it says what it says, EPA ends up through lawsuits with whoever it is and their own people, ending up doing something entirely different than what we expected when the law passed. And I think some of these changes that are being looked for by people can be made and will be made by the administration. I hope that's one of them.

Senator MURKOWSKI. Is your concern primarily the interpretation of the act or the application of the regulations, or a little of both?

Mr. MUELLER. My concern is with the regulations that EPA has written to interpret the act, the basic regulations are faulty. And I think that's true in many cases.

Senator MURKOWSKI. I think that is the extent of the questions, Commissioner, and again thanks very much for your testimony.

Mr. MUELLER. Thank you very much.

Senator MURKOWSKI. We are going to have a panel as the next group of witnesses. Assuming we have an accurate list of those that are here, I would call on Michael Hoyles, and you can correct me on that pronunciation, Mike, of the Anchorage Department of Environmental Conservation. Is Mike here?

[No response.]

Senator MURKOWSKI. Well, then he's not going to correct me on the pronounciation. Glenn Shaw and Tom Gosink, would you join us, from the University of Alaska Geophysical Institute. If you gentlemen would be seated in the most comfortable seats you can find. And we'll call on Jeff Welstin; is Jeff with us?

[No response.]

Senator MURKOWSKI. All right. Dr. Ralph Wells? I also would like to note for the record, that Mr. Leo Kaye of Anchorage, the executive director of the Alaska Lung Association, had planned to be here. However, his schedule was such that he could not attend. He asked that his written statement be included in the record and it will be so ordered.

Gentlemen, are you all set? Glenn and Tom, we welcome you to the committee hearing and would ask that you proceed at your convenience with your testimony; we're delighted to have you gentlemen. Would you identify yourselves and whoever wishes to speak first may proceed.

Dr. GOSINK. Tom Gosink from the University of Alaska Geophysical Institute. I really don't know what is desired here this morning. I simply received a call last week. I have done some actual research plus literature research on the pollution around the Fairbanks area. I mailed a copy of a nontechnical report. I don't know if it arrived in your office before you left.

Senator MURKOWSKI. No, we've not received that yet, but we'll look forward to receiving it.

STATEMENT OF TOM GOSINK, PROFESSOR, UNIVERSITY OF ALASKA GEOPHYSICAL INSTITUTE

Dr. GOSINK. OK, fine. Just listening to some of the things that went on earlier here, it continually seems to revolve around the carbon monoxide question. No matter what you do it comes out carbon monoxide, and it certainly is a good handle by which to gage the amount of pollution that's going on. But it is certainly not the only form of pollution that is going on; nor is the dust problem which is unusual and severe at times here in Fairbanks; nor is the sulfur problem, which is actually a nonproblem in the State of Alaska. I would concur with the idea of eliminating the sulfur regulations for the type of coal that we have here in Alaska. There are a lot of other pollutants that exist in the air, some of the polynuclear aeromatic hydrocarbons and derivatives thereof. And then there seems to be a rather unique new class that people hadn't really looked at before. And I believe—it points that way—it's probably as a result of introducing catalytic converters on cars. One of the most unique things we found this last winter when we just did a quick study, it was a rather impromptu thing, was rather than having acidic precipitation, this ice fog, it was extremely basic. And we found high concentrations of ammonia. And I'm still waiting for an analysis to see whether or not there are organic amines around. The literature which exists which suggests that there are organic amines. Now the reason for concern about this is that nitrosamines are formed in the presence of nitrogen oxides, of which we abound during ice fog conditions and it is very rich in the Fairbanks air. And these are one of the most potent carcinogens known.

The situation is even worse in that nitrosamine formation is favored by darkness; it's destroyed by light. We've certainly got plenty of that in the wintertime. And it's also favored by the fact that nitrosamine formation is favored by neutral to alkaline conditions which we definitely have in the downtown area.

Now, the—this type of pollution seems to be very localized. The downtown is by far the worst, and as you go out to the surrounding areas it gets better and better. And the fact is at the airport we're definitely not worried about carbon monoxide and other pollution there. The airport was one of the cleanest sites around for the downtown ice fog affected area. The problem at the airport is twofold; one is noise and secondarily airport closure simply because of local generation of ice fog. And there is a serious closure time involved in the airport during those periods of the year.

The fact is, the most basic precipitation that we found was in the vicinity of the powerplants. Probably it's a combination organic amines and ammonia being produced, plus a little bit of dust fallout from the powerplant. Wherever you fire the ash there's a little bit that gets out and the metal oxides are basic in nature and there's so little sulfur in it that it doesn't neutralize it; so that is added to the ammonia. So we got the highest reading—in fact, it was almost pH 10; extremely basic. It's extraordinary. We went out looking, you know, for the usual acid precipitation that everybody finds every place else; and we couldn't find any. The only place we could find anything that was slightly acid was out toward the airport where it's a little cleaner or getting way out of town someplace where just a little bit of natural carbon dioxide gets into the system.

The MUS problem and other powerplant problems are a little bit unique also in that when we get to the extreme conditions that you find here in Fairbanks, the emissions from the powerplants which are about three times that of the automobile and home heating fuel, those emissions are not in the ice fog that everybody is effected by. Powerplant emissions generally are ejected quite a bit higher and you can see them up there as a separate layer. It's only after awhile when it really gets thick and you get mixing all the way through that you start getting those emissions mixed in. So there's a special problem there with that.

Somebody mentioned continuous idling before. I definitely do not recommend that as being an alternative because there are a lot of pollutants other than carbon monoxide that are coming out. I think Glenn will give you a demonstration of what is coming out. This bottle contains 100 percent pure ice fog that we collected last year. The stuff grows and it just falls out like precipitation. There's the stirred up sediment. It's coagulated now, but it would be totally opaque when it first comes out.

Senator Murkowski. Would you tell us how you gathered that, and where?

Dr. Shaw. Would you like to smell it?

Senator Murkowski. Well, if necessary. I'll take your word for it, though. What's the chemical composition?

Dr. Gosink. We have very still air conditions. And the ice fog simply sublimes from particle to particle and it gets larger and larger; and finally it just falls out. You just place a cleaned sheet out in various locations and come back every few days and clean it off. And there's no snow associated with this particular fallout.

Senator Murkowski. You mean that literally?

Dr. Gosink. Actually, there's no snow in this. There's no normal precipitation mixed in with this.

Senator Murkowski. So you put a sheet out and——

Dr. Gosink. A sheet of Visquene out and every couple of days, depending on how heavy the ice fog is, you come back and you scrape this material off and you bring it back to the lab. And these will have pH's that run anywhere from about—oh, say the more normal of about 5.8 down near the airport to about 9.9 in the downtown area. And if you take composite snow and ice fog samples, you also see that it winds up to be a rather basic pH 7——

Senator Murkowski. And that's snow and ice fog?

Dr. Gosink. This is 100 percent ice fog.

Senator Murkowski. Well, where'd you get the moisture in it?

Dr. Gosink. The ice fog.

Senator Murkowski. It's the crust, then, off the Visquene.

Dr. Gosink. Yes, it looks like snow only it's gray in color; it's not snow in the normal sense that it comes out of a higher cloud. It's strictly what comes out of the air simply because the air can't support all of that moisture in the vapor phase at these extremely low temperatures.

Senator Murkowski. Are there harmful pollutants in it?

Dr. Gosink. Oh, yes, there are definitely harmful pollutants in there. We did a few Ames tests on it for the polynuclear aeromatic hydrocarbons and it's loaded with them. It's as bad or worse than anything you'll find in any large metropolitan city throughout the world.

Senator MURKOWSKI. I was going to say it smells like downtown Washington on a hot day.

Dr. GOSINK. Yes. Dr. Reichardt has done quite a few more careful studies on the polynuclear aeromatic hydrocarbons, but we did just a quick look at it, and it's just loaded with these type of compounds. And we didn't do any microsomal activation which would be going on normally in your body. But it's definitely as bad or as worse as anything you'll find in New York City. And we have less than 1 percent of their population here.

You were talking about the higher emission rates for automobiles. I don't know, but in general I would sugest that the higher emissions would tend to favor carbon monoxide and these organic amines. That's my guess at this time. But one of the odd things that goes on is—the last I heard the definition of a cold start is below 70° F., which doesn't even come close to the conditions around here. Now, under what conditions these organic amines and other things form as a result of the catalytic converter is something that has to be researched. I would assume that at 0° rather than −40° you're getting some of this because some of the data in the literature shows that if you're getting just 5 percent enrichment in fuel over air, the quantities of these amines goes up from threefold to thirtyfold. And in very cold weather, you can lose as much as 50 percent of your fuel efficiency, so it's running very rich. Those are just some general statements I have.

Senator MURKOWSKI. Thank you, Doctor. I appreciate your responding on such short notice. We knew of the carbon monoxide problem, but we really were not aware of the other concentration of rather significant pollutants. I'm curious to know specifically where these concentrations are occurring, and in your opinion the sources. For cold start we don't seem to have an answer because it seems the answer lies in technology that's not yet developed, because you've got to start the engine and get it going before catalytic converters begin to operate.

Dr. GOSINK. Yes, definitely.

Senator MURKOWSKI. But we've not had very much notice or knowledge, evidently, of these other pollutants that you express a concern about.

Dr. GOSINK. This is something new. The analysis for ammonia done 20 years ago, more or less when they were doing the surveys that all of the EPA regulations are geared for, didn't show any ammonia that they could detect in the normal conditions and just traces under ice fog conditions.

Senator MURKOWSKI. But you indicated that some of these might be coming from the catalytic converters.

Dr. GOSINK. Yes, that's what the literature would suggest at this time. This needs research, and of course that needs funding.

Senator MURKOWSKI. Let me make one more point, is this unique to Alaska, Anchorage and Fairbanks? As a layman my knowledge of the catalytic converter is that it reduces the amount of pollution. Are you suggesting that in this case it does not?

Dr. Gosink. It reduces the amount of hydrocarbons at warm temperatures.

Senator Murkowski. All right, in this particular climate it may actually increase the pollutants?

Dr. Gosink. Pollutants of a different nature, that's correct.

Senator Murkowski. That may be, in effect, more harmful ultimately than the other pollutants?

Dr. Gosink. Over the long run, yes.

Senator Murkowski. Then should we not have catalytic converters?

Dr. Gosink. I don't know.

Senator Murkowski. You don't know. Are you working on that?

Dr. Gosink. If I could get funding I could.

Senator Murkowski. Well we don't fund out of Washington any more. It has to come out of the State of Alaska.

Dr. Gosink. No, really, a lot of the funding that goes for pollution research is for the purpose of satisfying lawyers' needs to know, and it doesn't satisfy the scientist's need to know. There's a difference there. Sometimes you can get information out of the monitoring data, but that is not research data per se. And that's one of the big problems. EPA keeps coming up with a lot of money now and then to do some research, but unless it comes out carbon monoxide in some form or another you can't get a piece of it. And there are a lot of things like polynuclear aeromatic hydrocarbons that are not being studied. And we know that they are dangerous, but—they're around us all the time, but we don't know what their mutual interactions are, or how dangerous they are. They're slow acting things, they need 20 years to show up as a problem in human beings. There are not standards set for these pollutants so nobody goes investigating on a monitoring basis.

Senator Murkowski. Well, I would very much appreciate it if you're so inclined within the next 2 weeks if you have anything more of a substantive nature that you would care to submit for the record, because your suggestion that in the unique conditions in Alaska the application of the catalytic converter may, in reality, cause us more problems than answers to our problems is of great concern. It would be very helpful because whatever is finally determined with regard to how Alaska should be treated during the markup of whatever bill the committee comes up with for the Clean Air Act and its extension may depend on such information. Because if it is the consensus that in reality we should have flexibility for exceptional situations, we're going to have to have some darned good reasons why Alaska should be granted an exemption because of the peculiar situations we have here. And your testimony certainly has been thought provoking; I thank you.

Dr. Gosink. Yes, the catalytic converter problem I don't think is just unique to the ice fog conditions, but I think it's characteristic of cold weather operations.

Senator Murkowski. Yes, well I don't think there's any question——

Dr. Gosink [interrupting]. And I don't mean 40° below, I mean just ordinary close to freezing weather.

Senator Murkowski. I'm not suggesting we get rid of the catalytic converter, but what I'm saying——

Dr. **Gosink** [interrupting]. No, neither am I.

Senator **Murkowski**. I know you're not, so the record is clear on that. But you've made an interesting observation that there are other things showing up.

Dr. **Gosink**. You trade one set of problems for another, apparently.

Senator **Murkowski**. Yes, and it has been brought out in other testimony that when automobile maintenance standards are usually checked out, why they're under optimum conditions; they're not done at 30° or 40° below zero. Thank you very much, Doctor. Dr. Shaw, I believe you have a presentation and we welcome you before the committee. And I'm sure that you'd be happy to share with any members of our audience here a smell from your jar. It's appropriate. If you haven't smelled—if there are any Cheechakos in the group that haven't smelled ice fog, why, that's probably the most ideal way to get it is out of a jar. Or come to Washington, D.C. Go ahead, Glenn.

STATEMENT OF GLENN SHAW, PROFESSOR OF GEOPHYSICS, UNIVERSITY OF ALASKA

Dr. **Shaw**. Yes. It's an honor to be able to testify, Senator Murkowski and gentlemen. I'm a professor of geophysics at the University of Alaska, working in the area of astrophysics and physics of the atmosphere, the lower atmosphere. I'll try to keep my remarks in plain English insofar as possible as opposed to technical jargon which scientists are, of course, all too prone to use.

The scope of the testimony I have is the geographical regions—pertaining to the geographical regions of the high latitudes and the northern polar regions of the planet Earth. I also have one or two recommendations. In fact, I was pleased to hear that Dr. Mueller had made the same recommendations.

I'll paraphrase my remarks. They pertain to total suspended particulates, which are one of the species regulated under the Clean Air Act. Dr. Mueller alluded to the fact that the regulations, as they're presently formulated, are somewhat naive. A lot of research has gone down the pike since the passage of the Clean Air Act. There have really been considerable technological developments. And we sometimes are prone to hide behind the law that seems a bit naive in view of some of the technological developments.

As for the total suspended particulates, I would make a recommendation in general that you and your staff on the panel have a careful look at this regulation and consider modifying it to reflect the fact that some particulates are respirable and dangerous to health; some particulates travel long distances and, hence, affect large geographical areas. But those particulates, unfortunately, don't make up very much of the mass of total particulate material in some location. For example, the deserts of New Mexico are out of standard. Coastal communities sometimes are out of standard on total suspended particulates because of sea-salt air that's always generated by breaking waves in the ocean. And Fairbanks is out of standard in the summer, but not in the winter. And, of course, Senator, you've lived here and you know that it should be out of standards in the winter if we had intelligent regulation.

So I think that this has probably already been brought to your attention, or will be, that it would make more sense—I've written this up in somewhat more detail—it would make more sense to modify the law to take into account the size of the particles and also their composition. For example, substances composed of compounds containing arsenic, selanium, mercury, and lead are toxic; whereas, compounds composed of sea salt or crustal material are not toxic. So the law should be changed, unfortunately at the risk of making it somewhat more complicated. But I think an intelligently written straight-forward quantitative law, even though it might come out on the sheets as a somewhat longer form, perhaps won't have the ambiguities that the present law has pertaining to particulates.

Now my second remark pertains to the acid rain problem. Acid rain is a problem, of course, where one State generates sulfur dioxide that converts and travels and eventually can affect, for example, the air of another State. This acid rain problem is much flaunted in the Northeastern United States because the bulk of our population is living in the Northeastern United States; and I believe because the Canadians, for instance, have expressed some concerns about the problem.

On the other side of the Atlantic a similar problem exists except it's more severe, and that is the black snows that are falling on Finland and the Scandinavian countries in general, Norway and Sweden. This is a problem that's growing. It has ecological impact. It's even giving the reindeer ulcers, from what I understand, or could be. There's some slight indications. This apparently is material that is injected, for the most part, in the Rhine Valley; heavy industrial air pollution—or industry—air pollutants from heavy industry in Germany; the flow of northern air masses into the Scandinavian countries and fallout on the snow.

I mentioned acid rain because it leads into a problem that we have to pay particular attention to in Alaska, and I recommend to you in the very strongest terms; in the very strongest terms. Based on scientific evidence, this is not subjective—I mean, there should be great attention paid to Alaska's unique environmental and geographical location. I say this in an air pollution meeting because it has been discovered in recent years, in fact just really in the last 2 years the results have become conclusive and generally accepted by the scientific community, that entire northern polar regions are, in fact, polluted by anthropogenic compounds.

Senator **Murkowski**. Would you elaborate on that?

Dr. **Shaw**. I'm sorry to use a 25-cent word. What anthropogenic compounds are, of course, is air pollution compounds coming from human activity. The finding is—and this comes from samplings, Senator, that we have carried out and other institutions have carried out at places like Barrow, Greenland, Bear Island, Spitsbergen, remote locations in the Arctic that were assumed a few years ago to be virtually free of pollution.

It was discovered much to the dismay of some of us who are doing this work that, in fact, the Arctic regions are quite polluted. I don't want you to get the wrong impression. They are not Los Angeles or Washington, D.C., but the pollution concentrations are considerably higher than any model had predicted and that any scientific investigator really had good reason to expect. The problem is most severe in the wintertime; it's almost nonexistent in the summertime.

Some of the compounds identified so far by our institution and by places like the Livermore Laboratory in Berkely, the University of Rhode Island, Max Planek Institute in Germany, several European institutes, we've discovered that there's carbon which comes from the burning of fossil fuel mainly during the wintertime; compounds like vanadium and manganese which are strong indicators of human pollution effect; and compounds like silicones and various complicated hydrocarbons that come out. Now, of course, we're all interested in knowing why this phenomena exists; how it could affect legislation or reauthorization of the Clean Air Act, and whether or not it's relevant. I think we're all wondering, where do the compounds come from; who is responsible for polluting Santa Claus' workshop? The answer to that is extremely difficult to come up with with no ambiguities whatsoever because by measuring radioactive compounds in the air, we're able to date the products; and they're 20 to 50 days old. That precludes tracing back air masses and identifying a specific source. However, a good deal of detective work has been done by various investigators. Some 200 investigators around the world now have been involved in this, but they've kept the results mainly to themselves. I think this is the first testimony that's been given on this level except for a brief State Department meeting that was held.

The Soviet Union, we think, with 90 percent confidence level to put in the necessary caveat, is responsible for at least half and probably something like 80 to 90 percent of the pollution.

I have here a book that I'd recommend that someone on your staff read. It's called "The Destruction of Nature in the Soviet Union" by Boris Komorof. It documents extremely severe pollution problems in the northern Soviet Union which apparently have come about unexpectedly. The reason I mention this particular book and ask your staff to at least have a look at it is to point out what can happen if polluting industries are allowed to do anything they want, if they don't regulate themselves which, in fact, they might very well not do. In the case of the Soviet Union, standards have been relaxed. The country has ended up polluting itself terribly. It's come as a shock to the Soviets and they're quite embarrassed about it. They aren't prone to talk about it; and the author is probably risking his neck.

The other problem I would like to mention in my testimony is the associated problem of Arctic haze, which has its source mainly in the Soviet Union; partly from industrial activity going on, we think in the Rhine Valley; and partly from industrial activity taking place in the Northeastern United States. This is a global or semiglobal problem and if the United States were, for example, to back up on the clean air legislation, we feel as scientists that the pollution in the Arctic regions, for example, could reach a level within two decades which would begin to have serious consequences upon the climate. And now I'm at the limit of what can really be done with science because of the turbulent and difficult nature of predicting long-term climate response and weather patterns. But preliminary models indicate that there will be within two to five decades, if pollution is to continue increasing as it is now—and perhaps it's the Soviet Union that's responsible, I would emphasize—climatic changes which could have economic impacts in the trillions of dollars in the case of the western agricultural belts, for example. Now, this is a rather strong statement to make. And I don't want that to be the theme of my testimony.

What I do want to be the theme of my testimony is that the Arctic is a receptable for air pollutants. The Arctic is a receptacle for air pollutants because there are very few clouds, there is practically no precipitation, and there is a very stable layer of air, as you Senator, of course, would realize having come from Fairbanks.

This points out that we have a more serious problem in the Arctic regions, particularly in the continental Arctic regions where the air is sheltered, Siberia, Canada, Scandinavia, and interior Alaska.

So I would recommend that, yes, Alaska is a unique place. And it looks as though we should, if we are to legislate intelligently, have special laws for this geographical region. Unfortunately, I think the laws will have to be somewhat tougher than they would be in the lower 48. And it disappoints me to say that because it's going to, of course, cause some problems.

Finally, I would like to end my testimony with remarks on the urban Alaskan air pollution problem. Fairbanks, for example, which is really the only community in this State that is living in the stagnant, stable, air mass does, as our new paradigms, our new way of looking at the problem of air dispersion would predict, have an air pollution problem. It has a growing air pollution problem. Some of the other people's comments are at variance with this, but our measurements at the institute of total suspended particulate material shows that this is becoming more of a problem as wood smoke burners become more commonly used in Fairbanks.

I would also add that part of the reason, that I don't think has been mentioned here, for the decrease in carbon monoxide has simply been that we've had anomalously warm winters since 1976. And if you plot the corrected carbon monoxide, taking the decrease in temperature into account, in fact, the carbon monoxide has gone up to a peak and held about level since the pipeline. So I don't know that traffic rerouting has—I don't know that there's any particularly unambiguous evidence indicating traffic rerouting has been particularly successful.

As Fairbanks develops, as industrialization around Fairbanks grows, it would only make sense to take our special environmental conditions that we have here in the interior into account and insist that industry or utilities or whoever it might be, perhaps even residential customers who are burning wood at some point might have to be regulated. Otherwise, Fairbanks and regions like Fairbanks could develop really quite serious health problems.

I should perhaps end these remarks with the observation that many compounds in Fairbanks, toxic compounds, cadmium, lead, arsenic, mercury, beryllium, heavy metals that really don't come under the legislation but are known to be toxic, I have found at extraordinarily high concentrations here in Fairbanks.

Senator Murkowski. Are these in the ice fog?

Dr. SHAW. Ice fog very well could be more of a blessing than anything else because it acts, as you can see from the bottle of gunk being passed around, it acts as a filter and it tends to remove particles from the atmosphere.

Senator MURKOWSKI. Where do these metals come from, Doctor?

Dr. SHAW. I really don't know, Senator. They must be coming from coals and fuels that are burned; and they must be present in every fossil fuel combustion. Why they are found here in such concentrations——

Senator MURKOWSKI. I know, but are they resident of Alaska in the sense that they were generated here or are they coming from someplace else?

Dr. SHAW. Presumably they're generated here because they're found in high concentration in the air of Fairbanks.

Senator MURKOWSKI. Yes?

UNIDENTIFIED VOICE. Pardon me. I'm involved with certain mining activities——

Senator MURKOWSKI. Are you going to testify?

UNIDENTIFIED VOICE. I can.

Senator MURKOWSKI. I would appreciate it if you would——

UNIDENTIFIED VOICE. But I might comment, this burning with wood——

Senator MURKOWSKI. Well, we can't pick you up because everything on the record must be spoken into the microphone, but we would like your testimony and you will certainly be given an opportunity later.

UNIDENTIFIED VOICE. OK.

Dr. SHAW. I believe I know what the gentleman might have in mind. The burning of wood does release metals. We, for example, have made some tests burning birch wood, measuring the compounds that have been coming out. And we do find zinc, bromine, compounds like those that come out of wood.

Senator MURKOWSKI. Your contention is that the ice fog may actually filter the pollutants, and it might be in the best interest from the category of health quality in the community that it's in existence?

Dr. SHAW. Ice fog causes airplane accidents and automobile accidents and psychological depression; and it's pretty nasty stuff; and people don't like it; regulators don't like it because it's visible to the eye. However, ice fog itself starts as pure water. It's perfectly harmless. If you go up to Chena Hot Springs, for example, and look at the vapors coming out of the hot springs there, they're perfectly harmless. Now they might become harmful when they absorb compounds that are naturally in the air that we put in from our human activity.

It is conceivable, although in my mind barely so, that the ice fog particles could act to inject the material deeper into the lung. But we have to do more research on that.

I think the more fundamental problem is that there is extremely low air dispersion in the Arctic. Incidentally, I'll leave you a copy of this article that just appeared in "Science."

Senator MURKOWSKI. They will be entered into the record, Doctor.

Dr. SHAW. And if you would enter this material into the record.

Senator MURKOWSKI. I have just a couple of quick questions because we're taking a little more time than I had planned.

Dr. SHAW. Yes.

Senator MURKOWSKI. Your testimony is, I think, particularly appropriate. Why do all the pollutants necessarily go to the top, so to speak. I think you generalized that it is the consensus that we are creating a pollution problem in the Arctic. I think you would concede that in our case it's not one that's being generated necessarily from Alaska residential pollution that's moving up there.

Dr. SHAW. No.

Senator MURKOWSKI. It's coming from someplace else. But it appears that in the industrial belt, if you will, that exists some 600 miles south of the Arctic Circle around the globe, these pollutants come to the top and we have this concentration in the Arctic, whether it's the Alaska Arctic, or the Russian Arctic, or the European Arctic. Are the winds flowing in a circular pattern so that it just moves up on the globe, so to speak, and it more or less sits there? And is this situation also true necessarily in Antarctica?

Dr. SHAW. Senator Murkowski, if you're having some difficulty understanding what's happening, don't feel at all bad because we certainly are, too, in the scientific community. However, it looks as though now, I think there's a general consensus among the experts, that the reason has to do—pollutants are received to area "B" from area "A" because the winds are constantly hanging and turbulent. However, by the time the winds, say from New York City reaches Kansas, generally speaking the molecules of contaminates would have been removed by clouds. They're the most important removal mechanisms. They act to agglomerate the particles and then eventually precipitate them to the ground; or by air turbulence currents. When there's turbulent air, the air occasionally—any given packet of molecules—will be brought close to the ground. And the particles will either not be able to slip in the airstream, or else will diffuse out to the surface and attach to trees or surface obstacles.

In the case of the Arctic during the wintertime, just in general there are very few clouds. The clouds that are present are very thin. The droplet size in the clouds is somewhat different and somewhat unfavorable to removing particles. So we have low clouds; that's No. 1.

No. 2, of course, we have the dynamically stable layers of air that instead of convecting around and stirring things up—which tends, of course, to remove materials—we have this ice box phenomenon. In Phoenix, Ariz., if you go in a store you'll see a freezer chest with the top open because cold air just sits there and stagnates. Very much the same thing apparently is happening in the Arctic. So the long-winded answer to your question is that occasionally pollutants are injected into this stagnant cloud-free atmosphere. Maybe 10 percent of the time pollutants will flow up from the Northeastern United States or from Europe; or most commonly, as I say, from the Soviet Union. They'er emitting some filthy things in the Siberian section of the Soviet Union. And when that happens the material spreads out over the polar cap and causes persistent air pollution.

Senator **Murkowski**. Do the Arctic pollutants include significant amounts of pollutants that are regulated by the Clean Air Act? Or have they been examined; ozone, sulfur dioxide, nitrogen oxide?

Dr. **Shaw**. Yes.

Senator **Murkowski**. They do.

Dr. **Shaw**. They include other things in addition. I don't want to give the impression that the Arctic is in violation of the Clean Air Act. The concentrations are relatively small. They're comparable to locations in Virginia, I would say; locations in the nonpolluted regions of the east coast that are still moderately polluted. I mean, after all, you don't just suddenly walk out of Washington, D.C. and leave the pollution behind you. The eastern part of the country is, in general, moderately polluted. We have roughly the same level of pollution as the background eastern seaboard over the general Arctic.

Senator **Murkowski**. Have you, at the university, or your associates ever measured significant concentrations of nitrosomines in the air in Fairbanks?

Dr. **Gosink**. No, sir, that's one of the most artifact-prone analyses that there is. We just came to the realization that these could come about as a result of looking over our data from last winter. Hopefully we'll get a few of those analyses this coming winter. It's about $100 an analysis.

Senator **Murkowski**. Pretty expensive. There was a statement that was made that perhaps, because of our uniqueness, we should have a very tough set of antipollution laws in Alaska or enforcement thereof by the State if, under the Clean Air Act, more flexibility is given to the State. Yet we seem to be somewhat at a conflict here because you also indicate that most of the pollutants and the real problem, with the exception of the concentrations in Anchorage and Fairbanks, of not only carbon monoxides but others, ammonia—but in reality the problem is long term in the Arctic and it's not originating in Alaska. And as a consequence, do you know or are you familiar with any agency on an international basis that's directing its attention to this growing problem in the Arctic areas? And if so, would you provide for the committee at this time or later with that information?

Dr. **Shaw**. Yes. Multinational litigation is becoming more common. And it is highly relevant if you look at the individual causes of this problem of Arctic haze. The Scandinavian countries are suing Germany; Canada is hoping to sue the United States in some instances——

Senator **Murkowski**. Who's hoping to resolve this, though, internationally? I know the lawyers will try.

Dr. **Shaw**. That's a very serious problem, Senator. The State Department is looking into this. We have testified to them twice. The Scandinavian countries have agencies now that are specifically addressing their attention to these. I think the agencies should get together. And the organization to do that probably is the World Meteorological Organization of the United Nations in Geneva.

Senator **Murkowski**. You know, we have been active in a program of late with the assistance of Senator Stevens and Don Young, and we've expressed great growing concern about a lack of Arctic policy within the United States. As you know, the research capability that we had through the Navy, under the naval arctic research, has been basically abandoned by the Navy. They have no interest in it. The Federal Government has not designated an agency to coordinate the Federal role in Arctic research. I think your testimony is extremely valuable because it points out, again, the necessity of having a Federal coordinating agency for the Federal role in Arctic research. It puts a whole new light on another area. Oftentimes we're carried away with just the development of the resource potential of the Arctic and not concerned enough about what you have suggested as a very real threat that can only be resolved by an international approach to the problem. Your testimony has been most valuable.

Dr. SHAW. Senator Murkowski, thank you. I would remark, to illustrate your point, I've gone through a fifth of a million of the taxpayer's dollars doing studies in Antarctica for the simple reason that it's relatively easy to conduct research in Antarctica. And I can give you some numbers there.

Senator MURKOWSKI. I couldn't agree with you more, and it was pointed out in some of our discussions in Washington that everybody will provide money for the Antarctic because we have international treaties. When you have international treaties, why, you want to stay up with what the Russians or the Danes or anybody else are doing. But in the Arctic, we're not doing it; and it's very unfortunate. Yes, Doctor.

Dr. SHAW. But we've had to beg for every penny.

Dr. GOSINK. Your last question about an international organization, that would be the WMO, World Meteorological Organization, which is U.N. sponsored. They're trying to look at all forms of pollution throughout the world.

Senator MURKOWSKI. Gentlemen, I want to thank you both for your very valuable testimony. And we appreciate it. And if you, again, would care to submit anything for the record, we would also appreciate that. It's been very stimulating and I do thank you. I think you've brought out some new ideas and horizons onto a problem that to solve we're going to have to look beyond just the current situation in the United States to a growing problem as a consequence of industrialization throughout the world. Thank you.

Moving right along, we have another panel. And this is under the general subject of prevention of significant deterioration. We have Mr. Frank Abegg of MUS, is that correct?

Mr. ABEGG. Right.

Senator MURKOWSKI. Welcome, Frank. Would you come up. Mr. Bob Hufman, general manager of Golden Valley Association. Bob, would you find a comfortable seat. Bob Sutherland of the Sierra Club. I believe we have representatives from the Alaskan Conservation Society.

We have Phil Nicpon of North Pole Refinery. Is Phil here? Phil. Anybody else you want to add? I wonder if we could have the gentlemen from Sohio, Ken Blower and Rik Shaffer.

Gentlemen, we certainly welcome you and do thank you for participating. I hope that you have found the testimony as thought provoking and stimulating as I have. I welcome you to the committee. There's no particular order here. Unless someone objects, we might go from left to right. Is there any problem with that? If not, I would call on Frank Abegg, Fairbanks Municipal Utilities System. We welcome you to the committee and we look forward to your testimony.

STATEMENT OF FRANK ABEGG, ASSISTANT SUPERINTENDENT, FAIRBANKS MUNICIPAL UTILITIES SYSTEM

Mr. **Abegg**. Thank you. I find myself professionally and personally involved in pollution. I am the assistant superintendent and electrical engineer at the municipal utilities powerplant. I'm getting more and more involved in pollution every year. Also, in the evening, some evenings, I spend my time as present chairman of the borough pollution commission, more as an industry expert and a concerned citizen.

As a starting comment, I'd like to say that probably our pollution problems and the effects of any acts are like watching a child grow up. If you look at the industrial plants yesterday and compare them today, you can't see anything, but over a decade you can. One of the major pushes of the Clean Air Act was to clean up the picture of the plants, the visual problems, which may, as a lot of the doctors that have been speaking here have indicated, may not be the real problems.

I have two pictures here of our existing plant. This was taken in 1967. And probably to a lot of people—we still get complaints when we do have problems. And this was taken in 1970. There's a little improvement—a better photograph, part of it, but there have also been improvements at the plant. But looking over yesterday and today you can't see them. And that's part of my problem here.

I brought a statement which I'll read at this time. The following comments attempt to address problems that Alaskans have recently had with the Federal Clean Air Act along with interpretations and regulations enforced by the Environmental Protection Agency.

The interior of Alaska is blessed with an abundant supply of low-sulfur coal which can be mined and made available for use at a cost considerably lower than fuel oil, $1.40 per million Btu of coal versus $6.80 for oil.

Senator **Murkowski**. $1.40 to $6.80?

Mr. **Abegg**. Yes, $6.80.

Senator **Murkowski**. OK, incidentally, I'm going to ask the participants for about 10 minutes of testimony and if it's convenient for you, I'd appreciate it if you could stay within that limitation. Go ahead, Frank.

Mr. **Abegg**. However, the recent experiences of local utilities in trying to secure a new permit to utilize this coal have been very frustrating. The final estimates for constructing a 100-megawatt coal-fired plant exceeded $2,400 a kilowatt. This cost compares to $150 a kilowatt for similar oil-fired generation plants. Nevertheless, the new permit was never pursued and the utilities could not afford nor justify all the EPA required plant systems to meet their requirements.

Since then these same utilities have become increasingly dependent on fuel oil. And as a result, the cost of power around Fairbanks has increased substantially.

The city of Fairbanks has been considering cogeneration, using its centrally located Chena Powerplant as a source of heat for a hot water district heating system, similar to systems successfully used in Europe. It is hoping to purchase a new coal-fired boiler of a range of 150 to 250 pounds per hour of steam, which would be similar to a heating plant at Purdue University.

To generate electricity using existing extraction turbine generators, this low pressure extracted steam would be used to heat the water, circulate it in the hot water heating system. The new boiler would replace three existing boilers, each 50,000 pounds per hour, which have been in operation since 1953. That's these right here in the photograph.

The new boiler would improve fuel efficiency as much as 20 percent, and it would be equipped with improved emission control equipment; specifically, for particulates. The district heating system expansion would provide heat to major portions of both residential and commerical buildings in Fairbanks.

This cogeneration scheme would improve the powerplant's energy production efficiency from a present 26 percent to over 60 percent. It is a commonsense approach toward energy conservation and will reduce fuel consumption overall within the community.

The new heating system will replace existing oil-fired furnaces which use almost 15 million gallons of oil a year. The switch from oil to coal would also be in the best interest of the Nation. According to a recent consultant's report to the city, Fairbanks could reduce its overall air pollution levels while stabilizing heating and electric costs for the next few decades. The answer is using a centrally located coal-fired plant to take advantage of fuel economics and the facilities to insure proper combustion and emission control.

At present, low-grade heat is discharged at the powerplant and creates ice fog from its warm cooling water at the river. The cogeneration phase would capture this heat and allow the community to get some use of it. The Arctic environment provides additional challenges both in production and in the consumption of heat due to the extreme temperatures encountered. I have attached the "Acres American Report" for your review.

The primary item needed to allow Fairbanks to pursue cogeneration will be a new coal-fired boiler permit for the city's Chena Powerplant. The State of Alaska Department of Environmental Conservation has studied the plan and are encouraging us to use it.

However, in their process for researching the current EPA regulations, it could make it almost impossible for us to get it. We intend to replace the three old boilers with a new one. The intent of the act is to reduce future emissions at the plant. The new boiler would be designed to meet the current State particulate standards. In fact, the new emission control equipment to be installed would probably improve its emission levels considerably over the existing boilers. This refers to emission levels at equal loads or at nameplate, which is 100 percent rate of capacity. These boilers have not been operating near capacity nor year around due to their inefficiency and poor reliability. So annual emission levels from them have not been representative of nameplate.

In 5 years from now, however, these three boilers will again be required to operate near capacity to meet expected load growth, and the emission levels will be approaching the State limit which would be over twice the emission level of a new boiler. They will also be burning more coal than a new boiler would at the same loads. It is obvious that a new boiler, which burns less coal and has less particulate emissions, should be encouraged. However, the current EPA regulations are written in such a way to discourage it.

The new boiler nameplate emission rate has to be less than the actual emission rate of the plant it replaces. The past 5-year emission rates of the three existing boilers will not be their emission rate 5 years in the future. The new equipment emission rate should be compared to the old boiler rated output emission rate. And I've attached the specific EPA rules that go along with that and the State DEC staff comments to cover what I'm talking about.

The current high cost of fuel oil has driven many customers to supplement with coal or wood at home, which may be a growing source of even greater pollution than central heating electric plants. These small furnaces are not as efficient and do generate large amounts of carbon monoxide. There is also growing evidence that carcinogens and heavy metals are emitted from wood stoves. And I think you've heard that already today.

The Clean Air Act is only enforced against people that generate more than 100 tons a year. And that's not going to be the home user. The purpose of the above statement is to show what impact the Clean Air Act and amendments are having on interior Alaska. This trend is not in the best interest of our Nation. We need some commonsense in the established pollution standards. Of particular interest are particulates and sulfur oxides for coal-fired boilers in Alaska.

The State particulate standards for existing plants is 0.1 grain per standard cubic foot. Chena five boiler at the city powerplant is rated at 200,000 pounds per hour of steam. This standard allows up to 50 pounds an hour of particulate to pass through the stack. This boiler consumes 40,000 pounds an hour of coal and emits about 65 pounds of particulate, a current collection efficiency of 99.84 percent. The State standard requires 99.88 percent or .04 percent more. The boiler was built in 1970 and was designed to meet the current TSP standards at that time of 0.2 grain or 100 pounds per hour.

Regular testing over the past 7 years has shown plant improvements. However, existing fly ash collection equipment is now operating at optimum efficiency, and a baghouse collector must be installed to reach the new State standard. Its construction cost is estimated at between $2 and $5 million. The city electric system generates an annual revenue of $9 million. So this capital project and expected maintenance and additional power requirements will require an immediate 7- to 10-percent rate increase. The present average power cost to the consumer is approximately 8 cents a kilowatt-hour, almost the highest in the United States.

In perspective, the State of Alaska has developed an air quality report which categorizes all known sources of pollution. It is interesting to note that the major source of particulates in the State is not from central power stations, but from windblown river sandbars and from vehicle traffic on dirt roads. Both of these other sources generate almost the same size and chemical makeup of particulate that coal-fired boiler plants emit. The dust is basically made of sand, lime, and clay.

In fact, the hills surrounding Fairbanks have many feet of silt deposited on them from centuries of wind carryover along the river valley. The vegetation and environment is surviving and healthy. So why the big effort to suppress coal-fired powerplants with extreme standards that are not consistent with existing local natural occurrences? The exhaust gases leaving the boiler are also much cleaner than any forest fire in Alaska where every year many hundreds of thousands of acres are destroyed or renewed, however you look at it.

You have to appreciate how large an impact the present power system has in interior Alaska. It does not equal the boundaries of the city of Harrisburg in an area larger than the State of Pennsylvania. There was a definite reason for the Clean Air Act standards to be established. However, making them too restrictive may only accomplish the opposite. Limited improvements to and zero expansion of existing central facilities may generate even more pollution from each individual user. The same comments hold for the current standards covering sulfur oxides.

At present, the Clean Air Act requires that virtually all coal-fired powerplants to be constructed use sulfur control equipment. The Alaskan coals are the lowest in sulfur content of all U.S. sources; a 0.2 percent compared to 5 percent maximum of eastern coals. The coal Fairbanks uses could be as low as 4 percent of the sulfur that eastern coals have. Yet all plants, no matter what the grade of coal, must attempt to remove at least 70 percent of the sulfur emissions at the stack.

The basic emission control device used throughout the industry is a scrubber which is essentially a lime-based chemical injection plant at the stack. These scrubbers consume large amounts of power and are very difficult to operate and maintain. So at best, they are usually only available to operate about 50 percent of the time. They have also proven very costly and manpower intensive. It is a fact that Alaskan coal-fired boilers emit less SO_x without scrubbers operating than the best state-of-the-art boiler system can do on Eastern State coals. Yet all new boilers in Alaska must comply and plan to install scrubbers.

These scrubbers produce a wet sludge that must be disposed of in an approved landfill. It could be an engineering challenge to handle this waste properly in the arctic environment where approved landfill sites and subzero temperatures are severe handicaps.

I hope it is becoming apparent why the planned 100-megawatt coal-fired plant construction costs were $2,400 a kilowatt.

The cogeneration report for the city of Fairbanks examined the overall pollution level changes that would occur throughout the area for the district heating project. The result showed an overall decrease in SO_x. The consequences of expanding the Chena Powerplant with new boilers and eliminating local building heaters was positive over the project life. This reduction in SO_x is even without installing scrubbers on future boilers.

It appears that scrubbers would only increase construction and operating costs, both items which must be weighed against the benefits of the project. The impact of handling wet scrubber sludge and its disposal problems would jeopardize the project.

Again, the current EPA regulations are not flexible enough to recognize the Clean Air Act's consequences and to allow for reasonable decisions on circumstances that could never have been considered when the act was written.

The State department of environmental conservation has tried to get EPA to recognize these facts and to reconsider scrubbers on Alaskan coals. Unfortunately, EPA has not.

In closing, Alaskans need some commonsense and flexibility written into the Clean Air Act standards. What is good for Washington may not apply to Fairbanks. The act should strive to do the following: Become a sensitive guideline for each State agency to follow, allowing the States to consider their environment, energy options, and each pollutant's actual impact. Only then can good decisions be made to balance the benefit and cost of such standards. Two, encourage the widest use of our limited resources; give special consideration to cogeneration or other schemes that have an overall positive impact on the Nation's pollution level. And, three, encourage powerplant improvements both in fuel efficiency and pollution control systems. The less fuel burned, the less discharge. Encourage expansion of central plants that can prove an overall benefit to the community.

It is a shame that Americans must resort to cutting trees down to provide an affordable heating system at home just because Federal legislation and EPA interpretation has made it almost impossible for utilities to expand and upgrade central heating electric plants at an economical cost. The result will be more pollution and is already affecting everyone's standard of living. Live trees serve a valuable purpose in this complex world of ours. Coal could also serve us well in the near future.

Senator MURKOWSKI. Thank you very much, Frank. You've made a good point, I think, of the sulfur content of Alaska coal, somewhere between 0.2 and 0.25 and the realities of eastern coal at 3- to 5-percent sulfur; and the mandatory requirement under the Clean Air Act that, regardless, you're required to remove 70 percent of the sulfur content. I wonder, in your opinion, if you would care to generalize if that 70 percent weren't a requirement, it would seem that Alaska coal might find a marketplace where none exists presently, perhaps in the East. My point being, it is lower sulfur. And from that standpoint, it would be more acceptable from an environmental point of view, but it's basically eliminated because of the requirement that you remove 70 percent of the sulfur from the coal, which I assume would basically make it economically unattractive—so my general concern is I wonder if this doesn't favor the east coast coal producers at the expense of potential low-sulfur Alaska western coal?

Mr. ABEGG. Well, they have different problems than we have in their environment. And I think we've heard today that maybe sulfur is not our problem, although we have to live with what's currently part of the Clean Air Act. It may be the wrong place to spend our money up here. The Alaskan coals, I think, will find a future in the Pacific rim.

Senator MURKOWSKI. Well, just on the surface, at least, the east coast is concerned about sulfur content.

Mr. ABEGG. That's their big problem.

Senator MURKOWSKI. We have low sulfur coal, but our coal is not marketable on the east coast because regardless you have to take 70 percent of the sulfur out of the coal. And if you start with low sulfur it's harder to take 70 percent out, I assume.

Mr. ABEGG. Right.

Senator MURKOWSKI. Tell me one more thing, what is the status currently of the effort to expand the steam system into some of the local residential districts? Is that still on target? Are the permits coming in; is the process going ahead, are you hung up or what?

Mr. ABEGG. Well, we lost our general manager.

Senator MURKOWSKI. All right. Well, you can always replace a general manager.

Mr. ABEGG. Hopefully. The bids were received for the construction of a pilot project. The bids were 50 percent over the estimate. And the timeframe to have it operating by this winter was awful tight for materials. The council has delayed action and they hope to have portions of the design project changed to improve the bidding and go out again.

Senator MURKOWSKI. All right. Is there any problem with the permit applications?

Mr. ABEGG. Those are the problems I'm talking about here, working with the State department of environmental conservation. They are concerned that the amendments, the PSD requirements, are going to be lengthy. And though they say we do have an argument with the way we operate here, but it's going to take a consultant.

Senator MURKOWSKI. It's going to take a consultant to do what?

Mr. ABEGG. Talk the same language.

Senator MURKOWSKI. For EPA or for MUS?

Mr. ABEGG. For MUS to state it's case against the EPA.

Senator MURKOWSKI. I see.

Mr. ABEGG. That was in the mill with our last general manager. We have to start over.

Senator MURKOWSKI. Do you infer that you can't make a proper presentation without a consultant?

Mr. ABEGG. Right, you have to talk their language and you have to fight on their battleground.

Senator MURKOWSKI. They have nobody that can talk your language is what you're saying, is that right?

Mr. ABEGG. Right.

Senator MURKOWSKI. That's, indeed, unfortunate.

Mr. ABEGG. Well, that's the name of the game. The last time we were involved with Golden Valley at Healy, we spent a million dollars trying to get the data that region X wanted when the numbers came down so low, they didn't agree that we were doing it right; and they threw it all out again. And that's when we decided well maybe it isn't worth it.

Senator MURKOWSKI. This was out of the region X in Seattle?

Mr. ABEGG. Right.

Senator MURKOWSKI. Out of the EPA Administrator's Office?

Mr. **Abegg**. Right. They accepted the instrumentation we were going to use, and we spent a lot of money buying it; picking out the spots; deciding what computer models to use. When it all boiled down to where we were getting some answers, they thought that we were too low and we should do it all over again.

Senator **Murkowski**. So the project here, from your comments, is not likely to be operational this winter?

Mr. **Abegg**. No, it won't be, not this winter.

Senator **Murkowski**. But you have reason to believe that with a consultant you might be able to prevail upon EPA to give you the necessary permits, but how much is a consultant going to cost you?

Mr. **Abegg**. Just to review and get a battle plan is estimated to be around $100,000; and then to go to battle with them and get the permits they're talking a half million dollars.

Senator **Murkowski**. Well, that is, indeed, unfortunate and again points out the fact that we have a very complex act here. And it seems to be to implement the act, why, as evidenced by most of the testimony nobody totally understands it. I do appreciate you bringing out those points, because I think it substantiates the concern that has been expressed by testimony that everybody basically, with few exceptions, is supportive of clean air and the resultant health of our Nation. But by the same token, you have specific instances such as you've outlined where you're actually reducing the pollutants and you still can't get there from here because of the way the act is structured and you have to submit to very expensive professional services. These are some areas that undoubtedly should be looked at. And your case was very well put, and I thank you.

Mr. **Abegg**. Senator, one last statement. We have had very good rapport with the State department of environmental conservation. We respect their interests and their decisions. They have had problems along with us getting any reasonable decisions from the EPA.

[Attachments to Mr. Abegg's statement follow:]

1098

CITY OF FAIRBANKS

DISTRICT HEATING DEVELOPMENT PLAN

SUMMARY REPORT

FEBRUARY 1981

ACRES

Acres American Incorporated
Suite 329
The Clark Building
Columbia, Maryland 21044
Telephone (301) 992-5300

3 - DISTRICT HEAT DEVELOPMENT PLAN

3.1 - General

The key elements required for successful implementation of district heating are:

(a) A need for heating during a substantial portion of the year

(b) A high density service area

(c) A reliable heat source operating on low cost fuel in close proximity to the service area

(d) Existing buildings which are suited for hot water or steam heating, or areas where new building construction is projected for the near future.

An assessment of the conditions in Fairbanks indicates that each of the above criteria is satisfied. The downtown section of the city, comprised, of both commercial/municipal buildings and residential structures, is higher in population density than many existing northern European district heating areas.

These elements have been combined with available information regarding heating loads in the city and growth projections to develop a district heating plan which will:

- Lower heating costs to the end user when compared to equivalent oil heat costs.

- Reduce dependence on oil as an energy source.

The results shown in Table 4, utilizing the above electric values, indicate that district heat could be provided to customers over the next twenty years at an average rate of $7.89 per million Btu's. This rate would decrease to $5.75 per million Btu's if electricity is charged at 4¢ per kilowatt hour, and would rise to $10.05 per million Btu's if the heating plant electricity was credited at 2¢ per kilowatt hour.

The net tariff for district heat is therefore sensitive to electricity credit, and the correct division of plant charges between electricity and heat production is therefore of prime importance to district heating system development. A thorough evaluation of present and projected operating costs and charges for both electric power and heat should therefore be conducted before a large commitment to district heating is made.

3.8 - Socio/Environmental Effects

The replacement of numerous dispersed heating systems operating on oil with a centralized coal-fired heat source will affect land use, air quality, waste disposal, employment, business activity, and requirements for city services. Some of these effects can be quantitatively evaluated, while others can only be discussed in a general manner.

Fuels substitution and improved cycle efficiency will produce the most significant environmental impact. The cogeneration process, which generates both electricity and district heat, requires less total combustion of fossil fuel than separate heat and electric power production processes. The total fuel mix also changes, from a combination of coal and heating oil to an exclusive use of coal.

The effect of these changes on air emissions is presented in Table ~~4~~ 5. Because very little additional coal is required to produce district heat (over that which would be required to produce equivalent electric power using Chena 5), emission levels for oxides of sulfur should decrease considerably when coal-fired district heating replaces oil-fired furnaces.

Oxides of nitrogen will increase slightly, and particulate levels resulting from the added coal combustion will exceed those now produced by oil-fired furnaces, even though high efficiency mechanical dust collectors are included on the coal boilers.

Figures 18, 19, and 20 compare expected total emissions from the cogeneration/district heating system with emissions which would be produced from separate electric generation and space heating processes producing equivalent electricity and heat. The period prior to 1986 is not presented, as only small amounts of district heat and power are produced during that time. These figures illustrate that the district heating development plan does not result in significant changes to emission levels beyond what would be experienced with normal power generation plant expansion.

The figures also highlight the increase in downtown emissions levels which could result from expanded MUS electric power production and normal expansion in space heating requirements.

Expansion of the MUS plant will require a permitting and review process, during which impacts on air quality will be assessed by governing agencies. Compliance with New Source Performance Standards and Prevention of Significant Degradation laws may require the MUS to install sulfur scrubbers or particulate removal baghouses to reduce air emission levels. However, the demonstrable net reduction in oxides of sulfur may result in ready acceptance of plant expansion for district heating.

Fugitive emissions from coal and ash handling systems will also increase as a direct function of the increase in coal use by the MUS plant. The level of these emissions has not been quantified, but these could be significant in the area immediately adjacent to the plant.

Development of cogenerating turbines to serve a large district heating load will reduce the level of warm water discharged into the Chena river from power plant condensers. During the winter months, warm water discharge contributes to fogging in the city; a contribution that will grow larger if condensing steam turbines are called on to meet the projected MUS electrical load growth over the next 20 years.

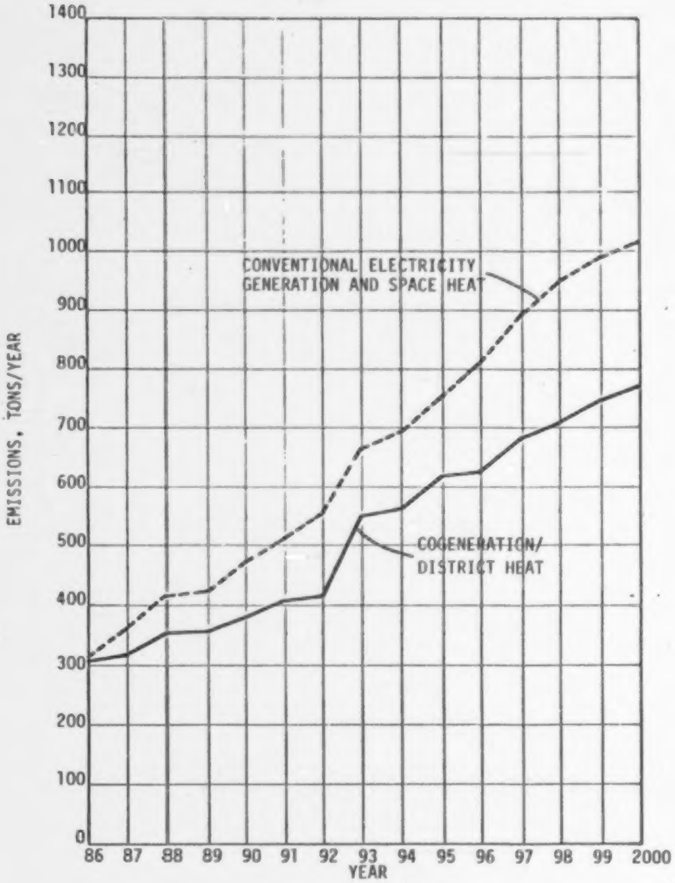
Implementation of a district heat system will reduce employment and business in the supply of oil for heating and maintenance of oil furnace systems. However, expansion of the MUS plant and installation of system piping will necessitate increases in plant staff and service personnel. Plant construction activities will also generate work, increase needs for community services, and stimulate the local economy over the 20 year construction period. Construction will also cause moderate disruption of selected city streets and will slightly increase needs for school and hospital services.

TABLE 5
(Revised 2/23/81)

ENVIRONMENTAL EFFECTS OF DISTRICT HEATING DEVELOPMENT

Column	1	2	3	4	5	6
				District Heat Emissions Impact		
Year	Total Coal Used, Heat and Power Tons	Coal Required for District Heating Tons	Oil Saved Gallons	SO_x Tons	NO_x Tons	Particulates Tons
1981	27,000	+ 1,500	268,400	- 2.17	1.65	2.23
1982	27,000	+ 1,500	268,400	- 2.17	1.65	2.23
1983	27,000	+ 1,500	268,400	- 2.17	1.65	2.23
1984	27,000	+ 1,500	268,400	- 2.17	1.65	2.23
1985	27,000	+ 1,500	268,400	- 2.17	+ 1.65	+ 2.23
1986	171,000	- 3,900	268,400	- 11.92	-12.99	- 7.03
1987	177,000	-13,400	1,253,100	- 46.98	-47.59	-24.55
1988	198,000	- 1,400	3,373,800	- 63.90	-34.15	- 6.22
1989	199,000	- 3,200	3,516,200	- 69.74	-40.32	- 9.89
1990	209,000	+ 3,300	5,582,300	- 95.58	-41.30	- 1.32
1991	224,000	+13,800	7,604,600	-113.42	-31.04	+14.56
1992	231,000	+18,400	9,384,600	-137.50	-34.60	+19.83
1993	305,000	+49,300	11,307,700	-116.70	+31.83	+49.28
1994	315,000	+47,000	11,692,300	-127.85	+22.14	+45.84
1995	345,000	+64,100	13,813,100	-135.57	+49.39	+65.18
1996	353,000	+60,900	15,933,800	-179.92	+21.64	+58.41
1997	375,000	+71,700	18,912,300	-214.60	+24.10	+68.69
1998	392,000	+76,400	20,890,000	-242.10	+19.03	+72.16
1999	412,000	+83,500	21,615,400	-242.47	+31.75	+80.38
2000	421,000	+81,900	22,285,400	-257.55	+21.38	+77.49

(-) values indicate decrease in net emissions.

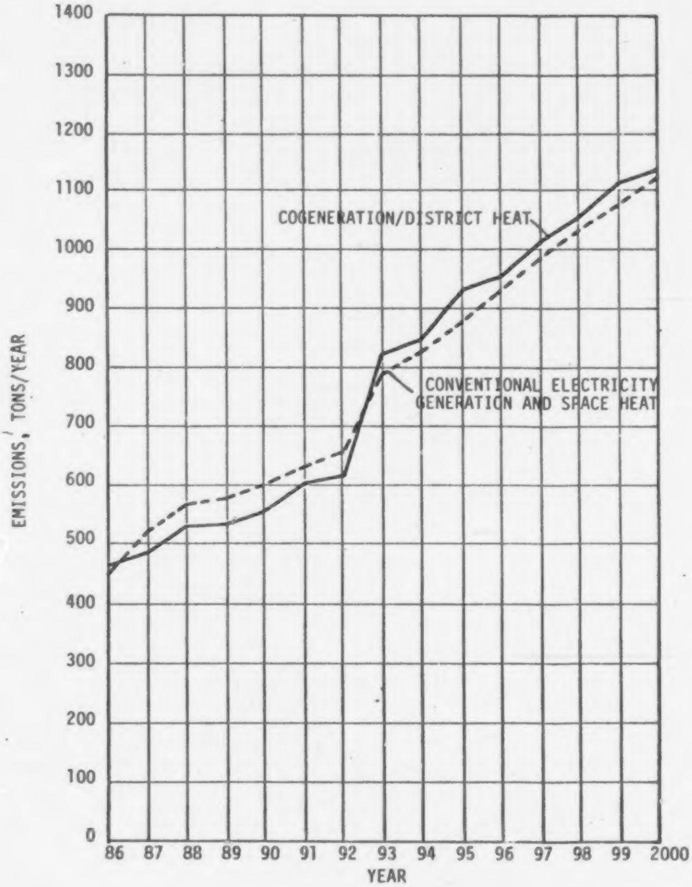


OXIDES OF SULFUR EMISSIONS

COGENERATION/DISTRICT HEATING
VS.
CONVENTIONAL ELECTRICITY AND SPACE HEAT PRODUCTION

ACRES

FIGURE 18

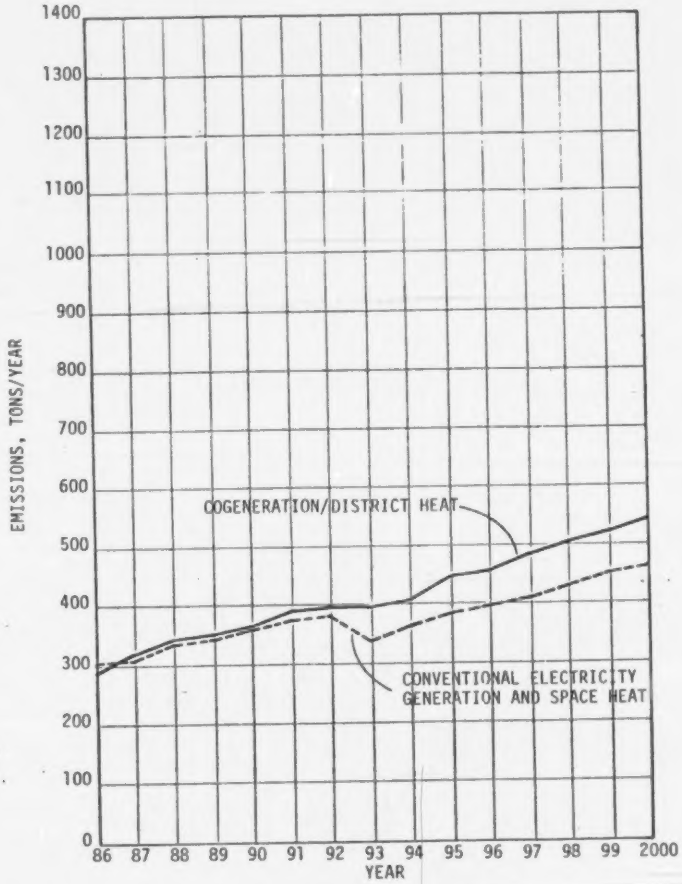


OXIDES OF NITROGEN EMISSIONS

COGENERATION/DISTRICT HEATING
VS.
CONVENTIONAL ELECTRICITY AND SPACE HEAT PRODUCTION

ACRES

FIGURE 19



PARTICULATE EMISSIONS

COGENERATION/DISTRICT HEATING
VS.
CONVENTIONAL ELECTRICITY AND SPACE HEAT PRODUCTION

ACRES

FIGURE 20

STATE OF ALASKA
DEPT. OF ENVIRONMENTAL CONSERVATION

JAY S. HAMMOND, GOVERNOR

POUCH O — JUNEAU 99811

May 11, 1981

Mr. Keith M. Sworts
Power Plant Superintendant
Fairbanks Municipal Utilities
P. O. Box 2215
Fairbanks, Alaska 99707

Dear Keith:

I have reviewed your February 26, 1981 letter and Acres report describing the proposal to replace Chenas 1, 2, and 3 with a new 150,000 lb/hr (237 mm Btu/hr) coal-fired boiler and/or the possible installation of a 250,000 lb/hr (395 mm Btu/hr) boiler replacing Chena 5, but as a co-generation unit. As I have told you in the past, current Federal New Source Performance Standards (NSPS) would not apply to the smaller boiler, but particulate matter standards would apply to the larger boiler. If the co-generating plant meets certain specifications, mandatory sulfur dioxide scrubbing would not be required.

The recent changes in Federal Prevention of Significant Deterioration (PSD) regulations are very complex, and may subject you to considerable expense in the preparation of a permit application. It would be prudent for you to retain a knowledgeable consultant to determine the applicability of certain definitions and review exemptions.

As you are by now aware, PSD review applies to certain new sources from which total emissions of a pollutant will exceed 100 tons per year and all other new sources which will emit a pollutant in excess of 250 tons per year. However, the review is also applied to modified existing sources at which the net increase in pollutants exceeds 25 tons particulate, 40 tons sulfur or nitrogen oxides, 100 tons carbon monoxide or 0.6 tons lead per year.

Under the August 7, 1980 regulations, potential controlled emissions (i.e., maximum emissions) from the new boiler would be compared with actual emissions from the three old boilers to determine the net change in emissions. Several possibilities and problems come to mind, and a sound argument would need to be developed to avoid PSD review.

1. The definition of "source" -- The three old boilers (sources) are shut down and a single new boiler (source) is constructed. PSD review would apply since the new boiler could emit more than 250 tons per year SO_2 and NOx.

2. The definition of "modification" -- Chena Station consisting of four boilers, is the "source", and by replacing three old boilers with one new boiler, the "source", Chena Station, is being modified. PSD review applies only if the net increase in pollutants exceeds certain values. This net increase is based on "actual" emissions prior to the modification and "allowable" emissions following the modification.

3. Location in a non-attainment area subjects the source to special review if the increase in carbon monoxide emissions will exceed 100 tons per year.

The most likely approach is to call the replacement boiler a modification of the Chena Station. Based on the significance levels for increases in pollutants which would require PSD review, a net increase in coal consumption less than the smallest number below would avoid review.

Significance Level	Coal Consumption
40 T/yr SO_2	8000 T/yr
40 T/yr NOx	5333 T/yr
100 T/yr CO	100000 T/yr
25 T/yr PM	2100 T/yr at 85% control (Ash of 12%)
	3200 T/yr at 90%
	6400 T/yr at 95%
	10700 T/yr at 97%
0.6 T/yr Pb	90000 T/yr

Thus you can see that if particulate emissions are controlled by a device of more than 95% efficiency, PSD review will be required if annual coal consumption increased by more than about 5500 tons per year due to NOx emissions. This means than you would need a permit which restricts operation of the new boiler to about 52% capacity (hours) and 40% capacity (total steam--not hourly rate) plus an amount of coal which generates NOx equal to the improvement in operations plus 5500 tons (or more if NOx is generated at less than 40 pound NOx/ton coal). Should you be able to show a markedly reduced NOx emission rate, SO_2 emissions would become limiting at 8000 tons new coal burned per year including any changes due to operation of Chena 5. Chena 5's operations would also have to be limited by permit restrictions!

To determine "actual" emissions, U. S. EPA usually looks at recent operations as being the past two years. However, your data shows that 1978-1980 cooperations were something like 30% below the 1974-1977 opeating rates. These four years could be easily argued as being normal since the more recent winters were warmer than normal and Chena 5 was more efficient.

To utilize the new boiler effectively, it appears a PSD review is unavoidable. Using simplified modelling procedures you may be able to avoid some ambient monitoring requirements if you can show pollutant impacts below the significant levels listed in Section 51.24(i)(8) of 40CFR. But modelling to show no violation of the PSD increments would be required.

Best Available Control Technology will need to be determined for the major pollutants which must balance cost effectiveness and ambient air quality impacts. I assume the results of such an analysis will require:

For NOx -- low NOx combustion techniques

For CO -- good combusion and maintenance

For SO_2 -- no control

For PM -- control device capable of reducing emissions to 0.05 - 0.10 gr/scf (150,000 #/hr) and certainly to 0.05 gr/scf for the larger boiler.

Looking at the future growth in steam demands listed in the Acres report and based on a review of past operating history and EPA's current PSD regulations, the review required appears inevitable. I suggest that you should contract with a consultant as soon as possible to do some preliminary modelling of the existing emissions and proposed emissions. His report should include recommendations for BACT and an ambient monitoring plan. We would be happy to discuss the results and recommendations before you contract additional work.

Respectfully,

Stan

Stanley W. Hungerford
Environmental Engineer IV

cc: Doug Lowery, NRO
Don Moore, FNSB

Senator **Murkowski**. Thank you, Mr. Abegg. We appreciate your testimony. I'd invite you to remain at the witness table. We're pleased to have Bob Hufman with us today. Bob, welcome to the committee and we do appreciate your staying with us as we deliberate. I know you have been an interpreter of the Clean Air Act, probably with some degree of frustration. and we welcome your testimony.

STATEMENT OF ROBERT L. HUFMAN, GENERAL MANAGER, GOLDEN VALLEY ELECTRIC ASSOCIATION

Mr. **Hufman**. Thank you very much, Senator. I appreciate the opportunity to offer testimony at this hearing.

In my opinion, the most onerous regulation contained in the Clean Air Act is that which requires removal of 70 percent of the sulfur contained in low-sulfur coal and 90 percent removal in high-sulfur coal.

Coal from the Usibelli Mine at Healy, which by the way is the only commercial coal mine in Alaska, averages about one-quarter of 1 percent sulfur content. Under the existing provisions, those industries burning high-sulfur coal, say 4 percent or above, and removing 90 percent of that would continue to emit more sulfur than plants burning our Alaska coal if no abatement at all was required.

Under these circumstances it should be obvious that such a requirement is ridiculous and imposes a tremendous and unjustified financial burden on industry using Alaska coal. This particular regulation was not conceived to protect the public health and welfare from a supposedly hazardous level of sulfur emissions but was promulgated at the urging of eastern coal interests to include the marketing climate for high-sulfur coal that was in competition with low-sulfur western coal.

Therefore, the Clean Air Act provisions that accommodate this completely unjustified regulation should be eradicated. Further, a revised SO_2 emission limit should be promulgated in a manner that will assure compliance with primary and secondary ambient air standards on a uniform basis and no longer discriminate between coals according to geographical locations and specific sulfur content.

I support attaining and maintaining air quality that complies with both primary and secondary standards that are designed to protect the public health and welfare. However, regulations that require excessive controls beyond those points are in most cases not justified from a cost-to-benefit viewpoint. For instance, in 1967 we built a coal-fired steamplant at Healy that cost $18 million. A mechanical particulate collection system was installed that removed between 70 and 75 percent of the particulate emissions. We conducted an extensive particulate sampling program in the area for 3 years using EPA approved high volume samplers. The results of these tests proved that the air quality in the plant area as it applied to suspended particulate matter was better than that required by both primary and secondary standards. That did not sufficiently impress EPA. We were required to install abatement equipment on that plant that cost $7 million in 1980.

It is occurrences such as this that convince me that a major overhaul of the Clean Air Act is long overdue. We need a more rational approach. And I sincerely hope that your committee, Senator, will make such a recommendation to Congress. Thank you very much.

Senator **Murkowski**. Thank you, Mr. Hufman. We very much appreciate your testimony. I know that you didn't write any of your testimony as I was questioning Mr. Abegg on the motivation for the 70-percent requirement. I appreciate you bringing it out by coincidence. In retrospect, the application of the 1967 construction of the Healy plant and the anticipated addition that was contemplated, I don't remember exactly what year, and I wonder if you could bring out for the record, from your recollection, the problems associated with concern over the air quality with regard to its proximity to Mount McKinley National Park and how much of a further problem associated with that proposed expansion was as a consequence of it being located just outside the park. It might be helpful.

Mr. **Hufman**. Well, as Frank Abegg mentioned previously, we did experience some extremely frustrating sessions with EPA region 10 in Seattle relative to the permitting process. And we did spend some $1,300,000 primarily having to do with environmental investigations and modeling and other test data that was a requirement of EPA prior to any consideration for issuing the permits that were necessary. The proximity of Mount McKinley National Park to our particular selected plant site was probably—well, was probably responsible for causing some of the delays. EPA was no doubt more concerned in that we were planning on building 4½ miles from pristine air increment that was dedicated for the park. They were also concerned relative to the visibility requirements, which at that time had not been totally defined by the EPA Administrator, Doug Costle. However, we were notified by EPA that prior to their issuing a permit, why that particular concern would have to be fully addressed. A little later we found that it was pretty obvious that Mr. Costle's interpretation of the visibility requirement had to do with somebody standing inside the park and looking out. And it was his feeling that the vistas outside the park should be unencumbered so that a person looking outside the park would not be offended for one reason or another.

Now, of course, we were concerned—due to the fact that you can see a long ways from Mount McKinley—by the time you climb to the top of Mount McKinley, we just wonder how many vistas, you know, Mr. Costle was really intending to protect. However, that was his interpretation. And we were also concerned relative to how he was going to handle the disposal of the fly ash in that it was classified as a special category hazardous substance. And those regulations have not yet been completed. However, some of the preliminary ones that we had access to led us to believe that it could cost us as much to dispose of the fly ash as its cost us to buy the raw product.

Senator **Murkowski**. It's my understanding, Bob, that the vistas themselves have not necessarily been totally identified, although I'm not certain. I know Wonder Lake and some others have. I'm going to be meeting with John Cook, head of the park service, in

Anchorage tomorrow, and I will ask the question and submit in the record to see if they have identified the vistas in the Mount McKinley National Park.

Mr. HUFMAN. I would appreciate that, Senator.

Senator MURKOWSKI. I'll see that you get a copy.

Mr. HUFMAN. Thank you.

Senator MURKOWSKI. Thank you very much, Bob, for your presentation. And I would ask and welcome Mr. Bob Sutherland, representing the Sierra Club. Mr. Sutherland, it's a pleasure to have you with us this morning and we welcome your testimony.

STATEMENT OF ROBERT SUTHERLAND, THE SIERRA CLUB

Mr. SUTHERLAND. Thank you for giving us the opportunity to speak today. I'd like to make note of the fact that a lot of the environmental organizations in the Fairbanks area were not notified of the meeting. And it was by chance that I happened to call your office to talk to you since you were coming back for the July Fourth holiday that I found out about the hearing.

I'd like to talk about the PSD program, maybe the visibility program, and a little bit what we'd like on low sulfur coal. The prevention of significant deterioration program protects all areas of the country which are cleaner than the national health standards, and obviously this includes most of Alaska. I'd like to challenge the assertion the PSD program limits growth or energy development. Since 1977 only one facility has had problems attaining a PSD permit, which was eventually granted a permit anyway. Major projects in Alaska have had no problem getting PSD permits. Furthermore, since States may redesignate areas from class II to class III standards if they wish to have more industrial development and pollution.

We see the PSD program as flexible and has not stopped development. The program enables State and local government also to budget their air quality resources in clean air areas. And if they wish to require standards—require applicants to install tougher pollution control equipment they require by the Federal Government.

As you can see, this PSD program permits local control, say, at the State level, which I think is probably a pretty good thing considering the Reagan administration these days.

It is my understanding, especially after today, that Hammond wants to keep our class I, II, and III standards and wants a strong PSD program.

I'd like to address the visibility program now. The visibility program is a correlary to the PSD program and only relates to class I areas. These requirements will stop only development if a State wants to stop it. I guess there are several waiver proceedings which were built into this program. I guess the Governor can grant a permit; also the President. At the Presidential level it's not challengeable in court.

The industry and State government has not tried to use these waivers. And since no facility has denied a permit because of this program it seems premature at this time to do away with it, which is based on prematurity and inadequate evidence.

I guess you might note that the program is designed to protect visual resources in States such as Alaska.

The low-sulfur coal, we've talked about the Fairbanks area and the program from the man from the Fairbanks Municipal Utilities System. We might give some thought to the fact that I guess there are States with variant amounts of sulfur in their coal. We might give some thought that elimination of this requirement could wreak havoc in the eastern coal-producing States where only high-sulfur coal is mined. I guess in Ohio alone 7,000 mineworkers are already out of work and this could exacerbate the situation.

Senator MURKOWSKI. I don't believe it was his testimony that is should be eliminated from eastern coal.

Mr. SUTHERLAND. Oh, well, right, but elimination of the coal——

Senator MURKOWSKI. I think it was just a generalization that the laws should be equitably applied. But, go ahead.

Mr. SUTHERLAND. What I see happening, Alaska has a large amount of low-sulfur coal. And what I can see happening is that this coal that's transferred to the Pacific rim States or, you know, Japan and Korea is already happening, I could see this moving farther east. And it could put people out of jobs, say, in Ohio, Pennsylvania, and so forth where you have this high-sulfur coal. I just mention this that you might give it some thought about the employment of these people. It seems likely that it means more jobs for Alaskans, I suppose, if we mine this coal and we'd do it in a sensible and environmentally sound manner. I just mention it; you might think about these people and what they have to—what happens to their job situation and what we're going to do with their productivity.

Also one thing I'm worried about is this pollution control is an integral part of protecting areas from visibility degradation. Also, I wonder about its effects on the long-range transportation of air pollutants such as acid rain, how that is going to affect our Canadian neighbors who I think are rather upset by this problem. I'm not technically—I don't have a technical capability of understanding this now, but it may be feasible to use our low-sulfur coal without scrubbers, especially if we have 50 percent—if they're only up in your plant 50 percent of the time, that seems like a costly—a cost overrun that we may not be able to absorb.

But in regards to our Canadian neighbors and what other pollutants that the scrubbers take out, we may have to examine this even though we do not have a sulfur dioxide problem here. Those are my comments.

I'd like to again say thank you for letting us testify.

Senator MURKOWSKI. Thank you very much, Mr. Sutherland.

Mr. SUTHERLAND. In the future, if you'd like to work with us, we'd be more than willing to make comments.

Senator MURKOWSKI. Well, if you or your associates would care to submit anything further, the record will be open for 2 weeks. I would like to advise you specifically that the following groups were sent telegrams; and these telegrams went out of our Washington, D.C., office about Monday of last week to Mr. Bob Weeden, president of the Alaska Conservation Society here in Fairbanks. I'm responding to your mention that notice was a little tight and I would concede that it was tight. I apologize for that. As soon as we found that we could have the hearing, we went ahead. Mr. Weeden was talked to last week by staff member, Mr. Dave R. Cline. The national representative of the Audubon Society in Anchorage was sent a telegram and two messages were left on his recorder last. Ms. Margie Gibson, of Friends of the Earth in Anchorage, was talked to personally by my staff last week. Gretchen Walker, president of the Fairbanks Environmental Center, was sent a telegram inviting attendance at the meeting. And my staff personally conversed with her last week. Eric Meyers, of the Alaska Public Interest Research Group, was invited to participate. The Coalition of Environmental Groups in Anchorage was represented by Eric Meyers. The Sierra Club was contacted in Washington at their headquarters. Who contacted them?

Mr. DeVore. I contacted them.

Senator Murkowski. All right. So we did make, under the time limits we had, the best effort we could. And again, I apologize.

Mr. Sutherland. Well, I realize that it was a slip. I talked to several people on Friday about this and they acknowldeged that ACS had been notified and that it probably had been a slip-up if the Sierra Club group here in Anchorage—as you know there is sometimes a mail lag or even, due to low funding, phone problems here.

Senator Murkowski. It's bad, yes. Thank you very much, Mr. Sutherland. The next witness to testify is Mr. Phil Nipon. No, Nicpon, excuse me, from North Pole Refinery. We welcome you to the committee and we look forward to your testimony, Mr. Nicpon.

STATEMENT OF PHIL NICPON, SENIOR TECHNICAL ANALYST, NORTH POLE REFINERY

Mr. Nicpon. Thank you, Senator. I'm the senior technical analyst with the North Pole Refinery, that's a division of Matco Alaska, Inc. I'm here this morning representing that entity. We concur with the legislative intent of the Federal Clean Air Act in that protecting and enhancing the quality of the Nation's air is a worthwhile endeavor in the best interest of all Americans.

Furthermore, as a member of an industry which can impact air quality, we are cognizant of our corporate responsibility to comply with or even exceed governmental regulations. I would like to point out to the panel, however, that regulations may not be thé only drive for industry—or reason for industry to improve air quality. It should come about by other means, say corporate economic incentives as well can also provide—help provide clean air. For example, conserving enegy, recycling and recovering resources, and improving physical plant efficiencies. All of these things are done to make us more industry cost competitive, but they also have the effect of reducing emissions.

Given our willingness to cooperate, our major concern is that any expansion or modification not be unreasonably delayed by the permitting process.

And another and final concern is the number of governmental agencies with which we as an industry have to deal. This adds uncertainty, unnecessary complexity, and increased probability permit delay.

And for these reasons we would prefer a regulatory structure of the Federal Clean Air Act totally based on local and State administration and enforcement. And as I sit here this morning and listened to some of the comments from the coal-fired power generation industry, I think perhaps that also regional standards might be appropriate to Alaska's unique conditions. It might be something to be considered.

I think that Senator Hart, he's the chairman of the National Commission on Air Quality, is coming up with advice on the Clean Air Act. I think in one of those cases he makes reference to the problem of high-altitude emissions. I think they might make recommendations as to high-altitude geographic areas might be a special case. And along with that perhaps Alaska as well. That concludes my remarks, Senator.

Senator **Murkowski**. Thank you. I might point out to you that the State or regional authorities would have an understanding of the particular unique problems of a State or region does run afoul of the auto emission problem which many States maintain the only way to handle is with Federal regulation and also with the acid rain problem. And again, I can assure you in the committee hearings that I participated in to suggest that Alaska or any other area should be treated as a separate issue doesn't fall on very sympathetic ears. The reason I continually bring this out is to point out that our delegation is relatively thin. Senator Stevens, of course, is on other committees. Don Young, over in the House, is the only representative that we have. And it's very difficult to argue unless we have a very, very logical argument about the merits of the peculiarities of Alaska. But that's why I think the testimony that's come out so far outlining some of the specific problems that are unique, whether it be the amount of sulfur in our coal, or the growing concern over national Arctic policy, to address what may be even a bigger threat; and that is the pollutants that are descending on the Arctic, is important. That's why this testimony is so valuable, because I think it gives us the opportunity to make a better case by providing facts that are generally unknown.

With that I would thank you for your participation in the hearing, Mr. Nicpon, and I would move on to Mr. Richard Shafer of Sohio, Alaska, which obviously has substantial investment in our State. We welcome your participation and your testimony.

Mr. **Shafer**. Senator, the organization that we'd planned for presentation would be for Ken Blower to make some introductory remarks and then I would follow up.

Senator **Murkowski**. All right. Mr. Blower, please proceed.

STATEMENT OF KENNETH E. BLOWER, CORPORATE ENVIRONMENTAL AFFAIRS DEPARTMENT, SOHIO

Mr. **Blower**. My name is Kenneth Blower. I'm with Sohio's corporate environmental affairs department. Rik Shafer is manager of our environmental affairs for our Prudhoe Bay operation. And together we'll summarize our written statement, which we'll provide copies of for you.

Our comments are focused upon the prevention of significant deterioration portion of the Clean Air Act and are roughly divided into three parts. Rik will relate Sohio's experience with the PSD provisions and the gaining of PSD permits for our Prudhoe Bay Oilfield. I'll briefly comment on some similar experiences that we have had in the lower 48 in obtaining permits for major facilities and especially our concern for future energy development, particularly the oil shales. And then finally, the third point of our testimony will be to identify needed changes to the Clean Air Act based upon our experience that we think will improve the process.

The general theme of our statement is as follows: we believe that there's been important progress in dealing with environmental concerns. And we have learned a great deal over the last 10 years about the process for achieving clean air. We certainly agree that there is continued strong support for achieving clean air. But we also feel that there is a growing awareness of competing issues, alternative approaches that can be used and analyzed for meeting our objectives but in a more sound and balanced manner.

Our experience indicates that the maintenance of a sound environment and the development of domestic energy resources, while some people may feel that they are in opposition, are mutually obtainable goals. Some of the projects that we will be talking about today, and particularly Prudhoe Bay, we feel are good examples of this dual objective of energy development and sound environmental management.

At the same time, our experience indicates that there are needed changes to the act. As you've already heard, we are in agreement that one of the features of most concern is the complexity, the uncertainty, and the delay that characterizes the PSD permit program. Our statement highlights some of the problems that we have experienced in working with the permit system. And by and large, these are problems that result from an overly complex and detailed program, a program that lacks the analytical support tools and the real scientific foundation that enable one to implement it in a clear and direct way.

We think it's important to note that the PSD program deals with welfare effects and does not deal with public health related concerns. Changes to the PSD program will not modify our national commitment to the protection of the public health through the ambient air quality standards. We believe this is an important distinction that enables us to consider the redirection of the PSD program to include our national goals of a sound economy, increased domestic energy production, as well as clean air concerns.

Now Rik will discuss our Prudhoe Bay activity.

Senator MURKOWSKI. Thank you very much, Mr. Shafer. We welcome you again.

STATEMENT OF RIK V. SHAFER, MANAGER, ENVIRONMENTAL AFFAIRS DEPARTMENT, SOHIO ALASKA PETROLEUM CO.

Mr. SHAFER. Yes, thank you. I might mention that I've been a resident of Alaska for about 9 years now. And during most of that period I've been involved in various petroleum related and environmental related issues. And I'm a registered professional engineer in Alaska.

The Prudhoe Bay Field, as probably most of you know, is operated by two oil companies on behalf of a considerably large number of lease owners. The two oil companies are Sohio, or the Standard Oil Co. of Ohio, and Arco, or the Atlantic Richfield Co.

Prudhoe Bay is presently classed under the Clean Air Act as an attainment area; that is, the air quality there satisfies national ambient air quality standards. Since the passage of the recent amendments to the Clean Air Act, we have obtained 3 PSD permits, and we have a fourth pending presently. The permits are primarily for gas-fired turbines and for heaters which are involved in both heating of the space, but more primarily for process heaters. Our experience to date is that it takes about 9 months from the time of application in order to obtain a PSD permit.

To date, our primary concern in our PSD applications has been with oxides of nitrogen levels, those being the levels which are closest to where we'd run into some problems with the regulations. We generally have had no problems with SO_2. Particulates have been related primarily to wind-blown dust and are quite local. We have had no problems with oxidants or hydrocarbons with respect to our permits.

If some of these other pollutants become an issue, we may have a problem with some of the methods for analysis that are used in the modelling. But so far we haven't.

One of the requirements under the Clean Air Act in a clean air areas is to conduct a 1 year air quality and meteorological monitoring survey. And we did that during the period April 1979, until March 1980. And this effort cost the Prudhoe Bay owners about $2 million. Each one of our PSD permit applications has represented a fairly substantial investment up to on the order of about $100,000, although recently I think our price tags have been somewhat lower as we've learned how to do it better.

The findings of the ambient air quality survey that we conducted as expected found the ambient levels of all criteria pollutants to be substantially below the national ambient air quality standards.

One of the chief concerns that we have with the Clean Air Act is in the detail and specificity required for PSD applications. Because we ordinarily would not want to make substantial investments in equipment before we had permits in hand, it is necessary to submit our PSD applications 3 to 4 years before the time of startup for a particular part of a facility. And because of this long advance time, frequently we don't have precise designs which would specify a particular heater size, a particular turbine size.

And there is another complexity that's introduced because of the long leadtime involved. If something happened, for example, in conjunction with the permits, which would delay construction or delay procurement for even a short period because of the problems with shipment of heavy loads by sea to Prudhoe Bay, we might miss a whole year because only a few weeks during the summer can barges can get through. Now, if we did lose a whole year because of some permit constraints, it in many cases would be necessary to go back and completely redesign the facility because as the field is produced, there are changes in the flow rates. And therefore, there'd be changes in turbine sizes and heater sizes that would have to be made.

I'd like to emphasize that presently we have good working relationships with both the Environmental Protection Agency and the

ADEC. And we have been able to obtain some accommodations whereby we could get permits which would allow us to install a specified horsepower total or a specified Btu-per-hour total in a given location.

Regulations presently require BACT [best available control technology] to be applied. And we think that this is a reasonable requirement. However, we have concern over the length of time that it sometimes takes to determine just what is BACT in a given instance. And we're concerned that special local circumstances may not always be considered when determining what BACT is. For example, some of the treatment methods on gas turbines that have been discussed would involve injection of water. In many parts of the country this would not be a problem, obtaining the relatively large amounts of clean water involved. But in the Arctic in the middle of the winter it's a real problem. I imagine you're thinking about the same thing.

Section 166 of the act would require, unless it's changed, more stringent rules regarding hydrocarbons, carbon monoxide, oxidents, and NO_x. Collectively we refer to these more stringent rules as PSD, set II. We consider that the BACT requirements that we presently have should adequately protect the environment and the public health without this increased stringency that would be imposed by set II.

In summary we'd like to request that the act consider the following points. First, the provide for a generic or nonequipment specific permits; permits that would cover a class of equipment and total horsepower or total Btu-per-hour load. We'd like to urge anything that can be done to reduce the permit processing time and complexity. And we'd like to improve the definition of BACT, and in that regard give consideration for local conditions as they affect BACT. And we'd like to propose that PSO set II is not needed at this time.

Again, we'd like to stress that we do have good working relationships with both EPA and ADEC. And to date, we've had no delays in construction stemming from permitting problems. However, the process that we have to go through to obtain a permit is a substantial administrative burden, and we don't see any real benefit from much of it. If there's no questions, I'd like to return it now to Ken Blower.

Senator Murkowski. Mr. Blower.

Mr. Blower. We just have a few more comments that would compare our experience in Alaska with what we've had in the lower 48. The air quality monitoring is, of course, something that we have to do wherever we seek a PSD permit. And we've conducted that air quality monitoring at five additional locations in the lower 48, three refineries and a chemical complex, and at our oil shale activity. We find that it basically costs about $250,000 per site to do that in an industrialized existing plant as compared to $2 million on the slope and as compared to much more than that if it's in a pristine area or an area where there's no industrial base to support that activity.

While the law, the regulation, requires 1 year of ambient data, we find that it can take between 1½ to 2 years to really do the job; and in one case up to 29 months. And the reason for that is that we have to seek EPA approval for all the monitoring stations; we have to obtain land for the monitoring site. And that's normally off our property because we're actually doing this in the ambient air. And, of course, we have our own internal procedures that we have to go through in defining the contract, hiring a contractor, and monitoring his work.

So it becomes much more than just 1 year for us; it becomes as much as 2 or over 2 years in many of our locations. A specific example that we've included as an appendix in our testimony which I'll provide is 29 months for a refinery on the Delaware River. And that was because of a number of problems.

A second issue that we would highlight concerning PSD in the lower 48 is the development of the shale oil activities. Many companies are involved in Colorado and Utah. Our company is involved in Utah. And in these areas the class I and class II increments for particulates and SO_2 have all the potential to act as a constraint in the development of that activity. Those increments plus the visibility requirements are, of course, a concern for us.

Speaking just a little bit about visibility, we've talked a little bit about how the air dispersion models are not very satisfactory tools; and they are the foundation that the PSD program is built upon. Visibility modeling is even less developed, so it's even more of a problem to develop the techniques and the predictive tools to handle visibility problems.

We have a number of other projects, and the appendix speaks to those in some detail where we've tried to highlight the cost of the program, the amount of delay associated with the specific permitting requirements. And I won't go into the details of that, but it is, of course, an important factor as we conduct our energy activities around the country.

We'd like to just summarize what we think the needed amendments to the Clean Air Act are. And we're summarizing from material that we jointly prepared with Sohio and the American Petroleum Institute. And a summary of this is included in our testimony.

First of all, in the class II and class III increments, we believe that the Act should be modified so that the main requirement for class II and class III areas is the requirement for best available control technology on all new and modified sources. Combined with this BACT determination would be a preconstruction review permit procedure to make sure that the standards were not violated in those areas, the national ambient air quality standards.

We feel that the increment system really should be eliminated for these class II and class III areas. And if we could eliminate the increment system, we believe we'd vastly speed up the permitting process, because we'd avoid base line determinations; we'd avoid increment tracking; and we'd satisfy many of the problems that we're having. And we believe that we could do that without any significant change in air quality.

We also believe that there are areas of the country which we normally talk about as class I areas, those areas that have unique scenic values and that we feel that an additional air quality review ought to be done on those areas over and above the class II or class III requirement.

Senator **Murkowski**. What are you proposing here; I don't quite understand?

Mr. **Blower**. We're suggesting that the increment system is not technically sound for both class III, class II, and class I.

Senator **Murkowski**. Well, do we have any class III?

Mr. **Blower**. There are no class III areas now.

Senator **Murkowski**. That's what I thought.

Mr. **Blower**. It's all class II and class I, that's right.

Senator **Murkowski**. And you're saying that in your opinion the application of the class I, II, and III could be improved upon?

Mr. **Blower**. We think that the increment system should be eliminated in all three of those areas. But we would acknowledge the importance of protecting some of these special areas, what we now call class I areas. And the way that we would suggest that should be done is to create or conduct a special air quality analysis whenever there is a class I type area designated and wherever there was a plant built that would impact that area.

Now, in lieu of the increment system many different approaches could be used. You could have a localized ambient air quality standard that would protect the uniqueness of that area. And the areas are differing in the kind of protection that are required. Certainly Alaskan areas, Western areas, and Eastern areas don't require the same type of protection.

So that type of air quality analysis may lead to a localized ambient air quality standard; it may lead to some kind of special visibility requirements; or some type of limited access waive that would allow the balance between energy and environmental matters.

We think that the act should be modified to focus on significant visibility impairment rather than any visibility impairment, as the act now reads any visibility impairment. Second, we think that a great deal more scientific study needs to be done before we're able to really predict visibility impairment and to regulate. So we would encourage any scientific study and EPA programs that would be aimed in that direction.

To solve some of our monitoring problems that we're related to you, the time and the cost associated with those, we feel the act should be restructured to require the use of data from Agency-sponsored monitors wherever possible. There is a great deal of ambient air being collected, especially in the lower 48. Many times we find that there's Agency monitors within one-half to 1 mile of our plant sites. Yet we find that we must conduct our own analysis to satisfy the requirements even though there's Agency monitors very near by.

And finally, as Rick mentioned, this PSD set II pollutant problem section 166 of the act, we feel does need attention because it would continually expand the PSD program into these other pollutants where there is already sufficient protection in the form of best available control technology.

I think that summarizes our experience. Basically, it's a problem of complexity, delay, uncertainty that we'd like to relate to you and ask the committee's attention on that matter.

Senator **Murkowski**. Thank you. In your opening remarks, Mr. Blower, you indicated, if I recall, a reference to the welfare effects in reality as a consequence of the interpretation of the act, vis-a-vis what should be in the best interest of the public health. Could you expand a little on that? I don't think I quite caught the true meaning of the point you were making.

Mr. BLOWER. Yes, sir, the point I was making is that our testimony is directed solely to the PSD portion of the Clean Air Act. Our testimony does not speak to or require health effects—in dealing with those PSD portions of the act, you're not dealing with a violation of the national air quality standards. Those levels are set. And by changing the requirements to the PSD program, we're merely changing the concentration levels that are cleaner than the air quality standards that are designed to protect public health. So we feel, both as Sohio and as the American Petroleum Institute, that it's very important to protect public health. And we would turn that job over to the regulators and to the scientific advisory bodies that are experts in defining what the standards should be.

The point is that PSD does not do that. There is already a review process that protects public health from these new facilities.

Senator MURKOWSKI. But what is what?

Mr. BLOWER. That is the nonattainment review process. If there's any concern in spotting a new plant, if it's even in a PSA area, one would have to go through analysis to find out if the standards were violated. If the standards were violated, you're not talking about PSD-type problems. So we think that the act is open and that it's open to redirection and rebalancing in this PSD area because we're not dealing with public health; we're dealing with welfare effects, things that can be measured in economic terms; where there can be a balance between economic, environmental, and energy related items. And that's probably a different balance than you would find in the national ambient air quality standard review.

Senator MURKOWSKI. As you require permits for your activities in the Prudhoe Bay area under the PSD program, you do run, I assume, immediately afoul of the realization that there is no deterioration until you put in the facility. And then there definitely is one. But yet, since it's classified as a class II area, why you can receive the permits even though it's more or less contradictory of the purpose of the PSD; because my point being there's no deterioration assuming we have a pristine area to start out with. But the State has been cooperative, is that correct?

Mr. BLOWER. Yes.

Mr. SHAFER. That's right.

Senator MURKOWSKI. And you've not had any difficulty?

Mr. SHAFER. I'd like to point out that with respect to all our permit applications, we have not exceeded either the national ambient air quality standards or the increments for a class II area in any of the models that we made for our PSD applications.

Senator MURKOWSKI. As you may potentially may be either encouraged or allowed, depending on what the circumstances might be, to explore in that 50-mile perimeter, which I believe is allowed under the interpretation of the Alaska Native Land Claims Act for exploration upon certain conditions being met in the Arctic Wildlife Area, that 50-mile fringe from the coast back, assuming that you meet those other qualifications—I'm speaking not as Sohio, but as the industry—what procedure would you anticipate having to follow that would be different than working in the Arctic today; or is this area basically included in the class II area now?

Mr. **Shafer**. The area in question is presently class II, so we'd face essentially the same sort of requirements that we've already faced at Prudhoe Bay. It's far enough away; I'm sure under the present act we'd have to conduct a new 1-year monitoring survey. We, of course, would have to do PSD applications for each new set of facilities we proposed.

Senator **Murkowski**. Well, I think you made a good point, a unique position, your logistics problem, your ability to ship in a very limited timeframe, and the time-consuming process in receiving permits and so forth. I have one other question, Mr. Shafer. I believe that new source performance standards would exist for your new gas turbines which you mention regardless of the PSD program. Have the PSD requirements resulted in more stringent controls than would be required by the new source standards or not?

Mr. **Shafer**. I think that the only thing to date that we have done which might be different than without the Clean Air Act is we have used low NO_x burners on certain heaters in the plant. It's really made no difference in the way we would design or operate anything else that we would have up there.

Senator **Murkowski**. Thank you, gentlemen. I very much appreciate your testimony. And I think that the entire panel has been most helpful in providing us with a good deal of information which will be reflected upon. And I want to again emphasize that all the remarks here will be entered into the official record of the committee. I think the testimony has been quite substantive. I would excuse you gentlemen and ask the next panel to come up. This is the next to the last group. We have five members that we're going to ask up, the new source performance standards panel, as it's called on the witness list. After that we have three or four additional witnesses that have indicated their willingness and interest in presenting their testimony. That will conclude the hearing on clean air here in Fairbanks. But I did want to give you some feeling for what the timeframe looked like. As I indicated earlier, we do intend to go through the lunch hour and finish. I would call upon Mr. Ed Oetken, environmental director, Alaska Lumber & Pulp Co. of Sitka; Mr. Bob Higgins, the Louisiana Pacific Corp., Ketchikan, formerly Ketchikan Pulp Mill; and Mr. Doug Smith, Noranda Mining Co., Greens Creek Mine on Admiralty Island; Mary Beth Juday, president of the Alaska League of Women Voters in Fairbanks; and Mr. Scott Ronzio of Arco, Alaska, and again, I would ask that you correct me on the pronunciation.

Mr. **Ronzio**. That was Ronzio, sir. I was prepared to speak to PSO and visibility.

Senator **Murkowski**. We will give you your prerogative of coming up and speaking as you wish. I would point out that I think we've had a good representation from the geographic locations of Alaska. I would observe that we particularly welcome the gentlemen from southeastern Alaska. They probably represent the most important single resource of all the resources of our country inasmuch as they produce paper, and that's something the Government certainly couldn't do without. So with that general framework, I would ask that we start on the left again. And, Ed.

STATEMENT OF EDWARD R. OETKEN, TECHNICAL AND ENVIRONMENTAL DIRECTOR, ALASKA LUMBER & PULP CO., INC.

Mr. **Oetken**. For the record, my name is Edward R. Oetken and I'm appearing today for the Alaska Lumber & Pulp Co., as its technical and environmental director.

The statement I'll present is more focused on general comments on national ambient air quality standards, SIP's and PSD's; not particularly on new source performance standards.

Thank you, Senator Murkowski, for holding this timely hearing in Alaska. The reauthorization of the Clean Air Act is one of the key pieces of legislation which the Congress will be taking up this year. It impacts industry nationwide as well as in Alaska. You are to be commended for taking time from your busy schedule to make certain that the views of Alaskans are made adequately known to Congress as it goes through this reauthorization process.

Alaska Lumber & Pulp does not favor a gutting of the Clean Air Act. We think the basic principles and concepts set forth in the act are reasonable and in the public interest as looked at nationally and from the perspective of the State of Alaska. However, we do believe that fine tuning of the act is necessary. In general, it is our belief that this State should have more authority in implementing the Clean Air Act and that there should be less involvement of EPA. Also generally we believe that the rules for prevention of significant deterioration need to be made less burdensome.

Turning to national ambient air quality standards and SIP's. EPA's main contacts with the States under the Clean Air Act are twofold: First, EPA sets the primary national ambient air quality standards for certain pollutants and is supposed to set the secondary standards for other pollutants. And second, EPA must approve the State implementation plan.

With respect to the standard setting, we are concerned that there is no independent scientific review of the primary standards currently set by EPA. We would propose that an independent scientific body such as a National Academy of Sciences evaluate the scientific bases of EPA's criteria documents, health staff papers, and the air quality standards every 3 to 5 years to insure maximum validity of the standards at all times.

Section 109 of the Clean Air Act requires EPA to set secondary national ambient air quality standards to protect against adverse impacts to the public welfare. The public welfare is defined to include effects made such as those on soils, water, crops, vegetation, man-made materials, animals, wildlife, weather, visibility, and climate, damage to and deterioration of property, and hazards to transportations as well as effects on economic values and on personal comfort and well-being. We believe that the States are in a better position to deal with these site specific issues than EPA. Accordingly, the great weight should be placed on the input of the State in setting secondary standards. We are not suggesting at this time that the States take over the secondary standards, only that a mechanism be placed in the law to maximize the impact of the State's position in EPA's determination of what they shall be.

Not only do we believe that the State should have a strong say in the setting of secondary standards, we also believe that there should be a major change in the manner in which the State implementation plans are reviewed by the Federal Government. For example, we believe that requiring two formal rulemaking procedures to approve a SIP is unnecessary. We believe there should be only one such review by EPA. Such a review should only be with respect to the major criteria and should not extend to miniscule matters as is now the practice. Second, we believe that as long as an area is an attainment area, the State should be able to change implementation plans for individual sources without having to submit the change to EPA for its approval. In other words, the SIP should be a basic plan within which the States have the flexibility to make changes so long as the area remained an attainment area.

Turning to Alaska, we would like you to understand that we have great confidence in the way the Department of Environmental Conservation has handled environmental issues. On the one hand, DEC has protected the public interest in areas of water, solid waste, and air. On the other, it has been an extremely reasonable agency with which to deal and has sought to find ways by which both the environment and a proposed undertaking can be accommodated. As we've had comments earlier in the morning, we also appreciate the way in which DEC has acted over the years and believe it is a mature agency fully capable of handling much greater responsibility than EPA is able to give under the present act. And this is one of the reasons we would like to see this change be made in terms of State importance.

Commenting on PSD, we agree that no change should be made in the PSD rules as regards class I areas. However, the concept of PSD works against those areas in Alaska which had no development prior to August 6, 1977. The size of the increments which are allowed for class II and class III areas are the same all over the country. The increments allow deterioration of the air in addition to the deterioration which had already occurred in the air as of August 6, 1977. In most parts of Alaska there was no development as of that time. Accordingly, we will never be able to achieve the base development line which other areas were able to achieve. We will only be allowed so much development as can be attained within the allowable increments for class II and class III areas.

This could be changed by increasing the size of the increments in class II and class III areas. And I want to comment that all I want to suggest at this point is an idea, not anything in terms of an official approach. We do not have the scientific expertise to say today what the size of those increments should be. We can envision, however, a methodology which would allow an increment in such areas to be equal to 50 percent of the difference between the baseline for the area as of August 6, 1977, and the national ambient air quality standards. Thus, while a margin for clean air would have to be maintained, States like Alaska would have an opportunity to do more development that States where industrialization has already occurred. Pollution would not be caused in those parts of the country which already had a development as of August 6, 1977, since the baseline from which the percentage would be computed would be higher. This would eliminate the unfair advantage that some States now enjoy by virtue of having been developed earlier without creating pollution problems elsewhere in the country.

We believe that the State of Alaska agrees with us that the class II and class III increments need to be expanded. We also know, as commented earlier this morning by Commissioner Mueller that the State is working on a proposal for doing this. Our suggestions should not be read to conflict with the position that the State ultimately adopts on this issue. It is just an idea that we would urge you and the State to consider.

In conclusion, thank you for the opportunity to make these comments. We will provide you with more specific proposals in the near future. Again, we believe that it is most constructive to have these hearings in Alaska so that we can raise issues of concern so that we can be informed of how the matter is being addressed in Washington. Thank you.

Senator MURKOWSKI. Thank you very much, Mr. Oetken. We very much appreciate your testimony. I believe you used the phrase that we very possibly will not be able to achieve the development that others have achieved. I think you phrased that in a way that would imply that we are perhaps unfortunate in not being able to achieve what I assume is a generalized destiny of some type. Is that, in your opinion, as a consequence of the fact that this other development took place before we had the stringent regulations that we presently have? And is it not perhaps better that we are not achieving the same degree of growth recognizing that the reason we can't is because of the law that protects the health and clean air? And is it not conceivable that because of the unique circumstances that exist in Alaska that have been pointed out in the testimony already presented here, whether it be the concern over the pollutants that are evidently—that we have reason to believe are going around the true Arctic, that perhaps there's only certain types of development that should take place in Alaska as a consequence of its uniqueness? We've heard testimony expressed today on the difficulty of eliminating the carbon monoxide because of the lack of technology available to do something about the cold start where it all occurs. And I'm wondering if you could generalize a little bit on whether or not from the standpoint of your industry which is base industry for Alaska, the production of timber for pulp, paper, and lumber products, you're competing with a world market with firms that operate throughout the United States that have to live unde the Clean Air Act as well but may have operated longer because they were established prior to the implementation. Do we have a disadvantage in reality, or might it be an advantage in the long run?

Mr. OETKEN. Basically, it's from the environmental—and I don't want to use the word burden detrimentally, but in terms of the environmental control overhead, a difficult situation to compete from an Alaskan site to other members of your economic world. In Alaska a business, particularly in our pulp line, has to be unique to survive considering the obtacles. The fact that we have a unique product as our base material, and that dissolving pulp which is the main item—in our particular case, speaking for Alaska Lumber &

Pulp, this product is a export item which contributes to our exchange. Our entire market is export as far as pulp is concerned.

We operate and try, in general, to take the position that there should be a balance between economics, job protection, future, the environment, and that the true impact of our operations in Alaska are very minor as far as deteriorating the quality of any increment of air. The problem is that the rules developments were made for the lower 48 environment. There you site an operation and there are people around you. There are fairly large land areas that are flat terrain around you. In Alaska, when we built the mill in Sitka we had to take the bottom of a creek bed, haul in sufficient rock and fill to make a level area large enough to construct the buildings on; and take the creek and divert it over to one side. We operate in a fiord-type situation where you don't have people; where your air emissions do not come into direct contact in the vicinity of the mill with residential development areas; but you do have mountain sides that go up almost as straight as your smokestacks. And these are the areas that are essentially being modeled by the monitoring stations.

So in general, our position is that what we're trying to do is not talk about the expansion of our industry, but talk about survival. And I think that's a better context to take my remarks in.

Senator MURKOWSKI. Well, that's a very basic one, certainly. You indicated the balance between the jobs and the economy, the production of resource to some extent, and the public health as it pertains to the application of the Clean Air Act.

Mr. OETKEN. Let me interrupt. There's no question on public health. There's no balance there. All we are talking about is the secondary standards in terms of the impact on the environment—and you were out of the room when I mentioned this. If I could just be redundant and read one paragraph again?

Senator MURKOWSKI. Go ahead. Because I wasn't out of the room very long, but I must have missed that.

Mr. OETKEN. I was talking about a review of the national ambient air standards every 3 to 5 years by an independent body. Section 109 of the Clean Air Act requires EPA to set secondary national ambient air quality standards to protect against adverse impacts to the public welfare. The public welfare is defined to include such effects as those on soils, water, crops, vegetation, manmade materials, animals, wildlife, weather, visibility and climate, damage to and deterioration of property, and hazards to transportation, as well as effects on economic values and on personal comfort and well-being. We believe that the States are in a better position to deal with these site-specific issues than EPA. Accordingly, we believe the great weight should be placed on the input of the State in setting secondary standards. We are not suggesting at this time that the States take over the secondary standards, only that the mechanism be placed in the law to maximize the impact of the State's position in EPA's determination of what they shall be.

My comments were addressed to these type of issues on the balance.

Senator MURKOWSKI. I understand, Mr. Oetken. I don't think it's appropriate in the case of Alaska, but it might be of interest that the State really needs the support of the Federal regulation rather than relying on the State because the industry or the industry groups as a whole would have to much influence on State government to maintain the public health interest as the primary interest. And for that reason they need the insulation of the Federal Government. However, I assume one might observe from the status of industry's relationship, which is a good one I might add, with the State government that we appear to not be swayed by the lobbying groups of industry, labor, or any other special interest group in the State of Alaska. Is that a fair statement?

Mr. OETKEN. I think more than a fair statement and that we can demonstrate very conclusive proof. Anyone who has had business with DEC knows that you can talk to them. But because you can communicate doesn't mean that they are not going to hold you to the line as hard as anybody that I know of. And last year, for instance, we put our three recovery boilers that we have on mill site, which burn process waste, into compliance because in working with the State on the very first unit we tried a variation of standard technology called wet electrostatic precipitation and it was the first application in our type of industry. And the unit was reasonably successful, but not as good as it should be. We progressed from there to a second unit, a boiler where we tried a scrubber unit which was not as good as the wet electrostatic precipitator. And then on our third recovery boiler, based upon our experience that we gained on the first installation of this wet scrubber—excuse me, wet electrostatic scrubber, we were able to improve the design. And instead of retrofitting the first two and to bring each individual stack, which are just several feet apart, at a very high cost we made the investment of several million dollars on the third unit at a high degree of cleanup; and in essence, brought these three stacks which are in very close proximity as a unit into compliance at a considerably lower investment than if we would have had to go back and rip out the installations and replace each one individually. And that's the type of constructive working relationship that I feel is being done here in Alaska.

Senator MURKOWSKI. Thank you. I have one last question. I'm aware of the expenditure that has been made in Sitka at the Alaska Lumber & Pulp Co. plant with regard to cleaning up your waste water and your installation of a secondary waste water treatment facility. As a consequence of that you have a problem of what to do with the sludge. I assume that one of the proposals looked at would be to drive the sludge out and burn it. But, of course, you'd come in conflict with the air quality standards which is something we've been talking about all day. I think it would be of interest to the record to have you point out that you eventually run a circle here and develop a bit of a dilemma. I assume that you have not seen fit to dry the sludge and burn it. So what have you done with it, and what permitting requirements are associated with that?

Mr. OETKEN. At the present time one of the problems—and I did not address it here because I thought it was a little bit outside the scope of the hearing but thank you for the opportunity—is that the control of the air, the control of water quality, and the control of solid waste are essentially nowadays handled separately by both the State and Federal Government agencies; and that the relationship of these problems are not addressed in the permitting process. Frankly, a common approach to the interrelationship is that when you consider the water problem, which is administered by EPA and results in a solid waste via the sludge, which comes under the responsibility of the State DEC, that's the other fellow's problem. These three things are completely interrelated. You cannot improve one without impacting the other.

At the present time we have one approved solid waste disposal site which, if we would haul out from our mill the amount of waste that we now have stockpiled, would be more than filled. It would be filled over our permit level. We do not have any other place that we've been able to identify to stockpile the type of sludge, woodwaste combination that results from the secondary treatment process. And as of this minute, we do not have a solution for the problem.

Senator MURKOWSKI. Then you have grave exposure in the long run of being overtaken?

Mr. OETKEN. The only modification I might make in that statment is in the short run. It's a today's problem. We're not talking about tomorrow. We are trying to identify a reasonable way of approaching the problem. We don't have an economic, realistic solution at the present time.

Senator MURKOWSKI. I think you've made the point, Mr. Oetken, that there is a close connection between the regulation of air, water and waste. EPA addresses it by putting it in different divisions, which isn't necessarily the answer. You pointed out the State does the same thing and makes it extremely difficult to deal with.

Mr. OETKEN. I'd like to just say that the State doesn't put it in the same way, they are the inheritor of the problem. They are recognizing the interrelationship and can't do what they would about it. And also, the final impact of all this is that the best way to obtain improvements for the environment is not necessarily in one particular area without considering the entire balance.

Senator MURKOWSKI. Now it'll be interesting to see how Ann Gorsuch relates to the problem. Thank you. We're going to move along with Mr. Bob Higgins, Louisiana Pacific Corp., Ketchikan. Bob, welcome up to the dry part of Alaska.

STATEMENT OF ROBERT HIGGINS, DIRECTOR, ENVIRONMENTAL CONTROL, KETCHIKAN DIVISION, LOUISIANA-PACIFIC CORP.

Mr. HIGGINS. Thank you. It's a real pleasure to come up here. I've never been here before. For the record, my name is Robert Higgins and I am director of environmental control for the Ketchikan Division of Louisiana-Pacific Corp. We would like to thank you for conducting this hearing in Alaska. We believe that it's rather unique to see an opportunity for Alaskans, of all areas of government, industry, and citizens to comment on the Clean Air Act and present their views. I would like to apologize to you for my appearance today. Alaska Airlines lost my luggage somewhere yesterday. They called me late last evening and told me they had found it, and somehow they managed to lose it between the Fairbanks Airport and my hotel.

Senator MURKOWSKI. Well, I thought maybe your corporate uniform was a bit casual. Don't feel bad, I know a gentleman that was the only passenger on a Cordova Airlines flight many years ago between Ketchikan and Juneau, and he saw his bag get on; and as far as he knows, it's still on that airplane someplace. Please go ahead, Mr. Higgins.

Mr. HIGGINS. My purpose in appearing today is not present a detailed, legal, or technical analysis of the existing Clean Air Act or of the various proposed amendments to the act. I would like, instead, to focus my comments on two points which based on my experience should be the touchstones of congressional consideration of amendments to the Clean Air Act.

These points are, first, simplification of the act and the regulations adopted under it. Second, increased State responsibility for implementing and enforcing the act. Even though our mill is a major factor in the economy of southeast Alaska, we are, by lower 48 standards, a relatively small business. As director of environmental control I am largely responsible for dealing with a host of State and Federal environmental statutes and regulations. I have a staff of seven people to assist me in this effort. We find it extremely difficult to keep up with the flow of regulations and developments under the Clean Air Act, the Clean Water Act, RCRA, Superfund, and many other regulatory programs.

In my view, however, the Clean Air Act right now is the most complex and perplexing. I attribute that in large part to the failure of the act to divide clearly the responsibility of EPA from that of the State in implementing and enforcing the act. Out of curiosity we reviewed the Bureau of National Affairs—Environment Reporter, a service to which we subscribe to try and keep up with applicable regulations. In that review we noted that there were nearly 75 pages of general EPA regulations and appendices relating to State implementation plans; and almost 40 pages of general EPA regulations and regulations relating to the Alaska implementation plan. In addition, EPA has 23 pages of regulations on delayed compliance orders; over 110 pages of rules and computer programs on penalties for delays in compliance with State implementation plans.

II find it odd and disturbing that these 250 pages of regulations do not and are not intended to establish specific limitations for air pollutant emissions from our mill. After all, these types of regulations are really the nitty gritty of the improvement of air quality. Instead, emission limitations for our mill are contained in a rather discrete volume of State regulations.

The purpose of EPA regulations are to tell State agencies how to go about developing their plans for implementing the national ambient air quality standards and to establish EPA's role in enforcing these plans once adopted. At no time under the act, as it's presently written, is the administration or enforcement authority turned over to the State. The result, in my experience, is unnecessary complexity and confusion. We're never sure whether we're dealing with DEC, or EPA, or both. We frequently don't know whether DEC has the final decisionmaking power or whether EPA has the final say or whether both do.

This complexity and the fuzzy overlapping allocation of responsibility between DEC and EPA are obstacles to the resolution of environmental problems. I'm sure that, as the case with all pulp mills, we have operating problems from time to time. Usually these problems involve technical aspects which are specific to the nature of our mill and our location in southeast Alaska. We try to handle these problems in a technically sound businesslike manner. Our practice is to discuss them forthrightly with DEC and to seek a mutually acceptable solution.

Our problem is that we and DEC often do not know where we stand vis-a-vis EPA and its massive regulations. It's my distinct impression that formal EPA approval is required for every detail in the scope and timing of orders and regulations issued by DEC. Even when EPA informally agrees that DEC should take the lead or concurs in DEC's approach, a separate formal EPA approval seems to be required. Until EPA takes that step, we may find ourselves in technical violation of a Federal statute and exposed to EPA enforcement action even though we're in full compliance with DEC orders or regulations. To say the least, we find such situations to be very, very uncomfortable and even frightening.

We firmly believe that the solution lies in simplifying decision-making power or whether EPA has the final say or whether both do.

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We firmly believe that the solution lies in simplifying the procedures and rules relating to the development and enforcement of State regulations and in placing more reliance on State agencies. This is particularly true in Alaska where lower 48 problems and solutions are not always necessarily Alaskan problems or solutions. DEC, in our view, has demonstrated that it has a commitment to and a capability of carrying out its responsibilities in a manner that is beneficial to all Alaskans. EPA's role should be a secondary role unless it determines, under clear standards, that DEC no longer has an environmental commitment to its people in this State.

In conclusion, Louisiana-Pacific concurs with the thrust of a number of points that Commissioner Mueller made this morning on behalf of the Alaska Department of Environmental Conservation. Again, I'd like to thank you for the opportunity to come to Fairbanks and express our views.

Senator MURKOWSKI. Thank you, Mr. Higgins. We do hope that your luggage catches up with you; right after you leave Fairbanks is when you'll get it. How many people in your organization are basically employed to work with or meet the requirements of a combination of the EPA and the DEC, Department of Environmental Conservation?

Mr. HIGGINS. In the Ketchikan location, I have seven people on my staff, all of whom spend a great portion of each working week with various rules, regulations, as I mentioned, ranging from Toxic Substance Control Act, to the Clean Air Act, to the Clean Water Act, and many others that I've even forgotten what are for.

Senator MURKOWSKI. You have seven people that work there because of the act, in effect?

Mr. HIGGINS. Yes.

Senator MURKOWSKI. And how many people are totally employed in the mill?

Mr. HIGGINS. About 625.

Senator MURKOWSKI. About 625. I'm sure that it's no secret that from time to time there's been a concern in the community as a consequence of the smoke that emerges from Ward Cove and flows across Tongass Narrows, and moves over to the general area of the airport which is not far away. And I'm wondering, is that in compliance with DEC and EPA? There's nothing you can do about the way the wind blows except remove the visibility, if that's possible; and in order to clarify the matter, I wonder if you would comment on it.

Mr. HIGGINS. I would like to, yes. We heard many complaints from bush pilots several years ago when we put a rather complicated piece of air pollution control equipment on our recovery emissions, which were primarily the emissions that cause decreased visibility in Ketchikan area; that they no longer had a beacon by which they could find their way home. In any event, we feel that we've made great progress in reducing much of the visibility problem that occurred in and around Tongass Narrows because of our operation.

And I'd like to comment just for a brief moment on the relationship that developed because of that problem with DEC. As Mr. Oetken mentioned, the two southeast mills were faced with a very unique problem because of the fact that our raw material, logs, are brought in on salt water and they're stored in salt water, which creates a problem in the process and resulted in the emission of very fine submicron, if you will, particulate which was primarily salt. We had to develop technologies. They went on one tack we went on another; and we developed technologies to remove the particulates from our emissions. The State recognized that we had a unique situation and that it was going to be difficult to comply with their emission requirements. However, they were very good to work with, in our case, and I'm sure I can speak for ALP also; and they allowed us enough time to really do research and developed control equipment, which we ultimately did. And we did it in a very cost-effective manner. I'm sure that had we been dealing directly with the Federal agency that we would not have had such a cost-effective expenditure or as an efficient piece of equipment as we now have.

Again, we can't always control the wind, but we think that we're controlling our emissions as well as we can. And we are in compliance, at the moment, with all applicable State requirements.

Senator MURKOWSKI. Thank you, Mr. Higgins. It's certainly comforting to know that when you come in on Alaska Airlines now that they don't follow the smell of the wood smoke on their approach, as they used to. I would call on Mr. Doug Smith, representing Noranda Mining Co., Greens Creek Mine on Admiralty Island; welcome, Mr. Smith. You represent, so far, the mining industry of Alaska. And we're aware of your interest and commitment on Admiralty Island. I think it's significant that your effort, along with that of US Borax at some point in time might actually result in the development of Alaska's second mine. As you know, in the Fairbanks area we do have the Usibelli Mine, which is the only major operating mine in Alaska. And it's a pleasure to welcome you before the hearing this afternoon. And with that, I would ask you to proceed with your remarks, Mr. Smith.

STATEMENT OF DOUGLAS SMITH, PUBLIC RELATIONS COORDINATOR, NORANDA MINING, INC.

Mr. SMITH. Thank you very much. For the record, I am Douglas Smith. I am public relations coordinator for the Noranda Mining Inc. We do have a property at Greens Creek.

And aside to the testimony that just preceded mine. As I recall when I lived in Ketchikan in the early fifties, you could get to Ward Cove and find out you were there before the pulp mill was in operation because Jim Lebow had a salmon reduction plant.

Senator MURKOWSKI. They called it the "stink" plant, as I recall.

Mr. SMITH. Yes. Mr. Chairman, this statement of Noranda Mining is responsive to your invitation for testimony relating to the possible amendments to the Clean Air Act. We support efforts to make the act work efficiently and at the same time provide needed health protection.

Noranda Mining Inc. is part of a joint venture group that has a mining property located on Admiralty Island in the Greens Creek Drainage near Hawk Inlet. The property lies within the Admiralty Island National Monument, but outside the wilderness as established by the Alaska National Interest Lands Conservation Act. Portions of this act deals specifically with the Greens Creek property in allowing the project to be developed. The mine will be underground and is planned to produce about 800 tons per day of ore with silver, gold, lead, zinc, and copper values. At present, several millsite locations and tailings disposal areas are being considered in the Greens Creek vicinity to develop a concentrate for shipment to an existing smelting site at either a foreign or domestic location. A draft environmental impact statement on the project is being prepared by the Forest Service for submission in March 1982.

The following specific suggestions are respectfully submitted: One, the elimination of preconstruction monitoring of air quality for the reason that the time and investment involved is not efficient for the results obtained. Two, with regard to NAAQS secondary standards, delegate this activity to the individual States to be enforced at their discretion. State and local knowledge of specific conditions would provide more efficient working of this provision.

Three, the subject of acid rain is one that is not completely understood. It is suggested that instead of investing moneys for acid rain monitoring as a research project, that the funds instead be directed toward identifying what acid rain is all about; also, that this work be under the National Science Foundation.

Next, prevention for significant deterioration, or PSD, increments associated with other pollutants should be eliminated. Some of the specifics such as hydrocarbons, nitrous oxides, and others are not clearly understood and would add to the already confusing PSD implementation.

Next, PSD increments should be only for class I areas and only on the basis for annual averages.

Next, in considering amendments to the Clean Air Act, thought should be given on how to handle air pollution episodes from natural causes. These events should not be classed as sources of pollution and should not be credited as violations.

Next, on the subject of best engineering practices, opportunity should be provided to have stack design to meet different terrain conditions. The present good engineering practice can be practically applied to flat terrain, but provision should be made for the use of taller stacks for plume dispersal for sources in mountainous terrain.

Next, suggested amendments to the Clean Air Act should consider a facility having an approved abatement system, have such a system immune from any retrofit order for a certain number of years. The reason for this is because of the large investment to achieve an approved system and the need to have time to amortize this investment that has led to the approved system.

Mr. Chairman, this completes Noranda's formal statement. One of the partners of the Greens Creek project, Martin Marietta Corp., has an environmental center in Baltimore, Md., and would be pleased to discuss specifics involving the proposed Clean Air Act amendments. In my prepared statement, the address of the responsible official is included. The gentleman who was expected to be here today, our environmental specialist, had other plans. I think he was chasing his luggage. We will be pleased to respond insofar as we can to your questions at this time and supplement such responses in writing during the time the hearing is open.

Senator MURKOWSKI. Thank you, Mr. Smith. I noted in your comments with regard to your proposed development that the smelting would occur outside the State of Alaska, either in a foreign or a domestic smelter.

Dr. SMITH. Yes, it would be with an existing smelting operation outside of Alaska.

Senator MURKOWSKI. Is that simply a matter of economics or because you're not in the smelting business and the amount of ore that you would take out of the Greens Creek would not support location of a smelter in Alaska?

Dr. SMITH. The latter comment that you just made is the case. This will be a relatively small mine and we would try to make arrangements with an existing smelting facility that also takes other concentrates.

Senator **Murkowski**. Now, the reason it happened to be of interest to me, in the hearing in Seattle there was a good deal of testimony surrounding the smelter's operation in Tacoma, which is the major smelter in the Pacific Northwest. Might you utilize that smelter?

Dr. **Smith**. If it's still available, yes. As you know, there's one in Montana that was announced to be closed recently, and I believe within the last year. And the announcement said that the copper material would be shipped over to Japan for smelting. And this has created a large concern about the remaining smelters that are left, and our balance of payments in all and number of concerns with the various metals that are necessary for our economic and our national interest.

Senator **Murkowski**. But you're not basing your economics necessarily on having to sell to a domestic smelter?

Dr. **Smith**. We have not precluded the option for either domestic or foreign capability.

Senator **Murkowski**. It would be a strange day indeed, from the standpoint of our strategic mineral supply, which is generating a great deal of notoriety now, that we would not allow, because of environmental concerns, the smelting of our metals in our own country. It would certainly be contrary to the concept of a strong Nation. You indicated a concern over the monitoring of air quality associated with your proposed project. And my question is, You indicate it's a small mine, how much capital investment do you anticipate; and how many people involved in the mine in the mill, in the mining process?

Mr. **Smith**. We feel we will have approximately $50 million-plus invested in the mine property by the time we get into operation in 1985. To date we have, I think, somewhere in the neighborhood of $10 million invested since the discovery of the mine property in 1973. We will expect to employ between 180 and 200 workers at the mine site when in full production.

Senator **Murkowski**. When you set up monitoring, though, and I assume you're out on Lind Canal, in effect, in that proximity of the outside of Admiralty Island, you're not doing anything; I mean, you have to monitor to comply with the act; by the same token you haven't done anything from an environmental standpoint, so what are you really monitoring, other than the local atmosphere as it exists on any given day?

Mr. **Smith**. I think that's a fair statement. And therein lies the dilemma. We have to comply with the existing act to get the necessary baseline data that is now required to meet responsibilities for the preparation of an environmental impact statement, which hopefully if approved will lead to a mine license.

Senator **Murkowski**. I think you've made your point well, sir. Thank you very much for your testimony. And luggage is a seasonal problem in this part of Alaska, it has something to do with the increase of tourist traffic. So, we do better in the wintertime.

I'm pleased to welcome Mary Beth Juday, president of the Alaska League of Women Voters on the panel this afternoon. We look forward to your testimony, and it's nice to have a woman among our group. Thank you for coming.

Ms. JUDAY. I'd like to make one correction. I am not president of the League of Women Voters of Alaska, I am a member of our State board of directors.

Senator MURKOWSKI. Go ahead, Mary.

STATEMENT OF MARY BETH JUDAY, MEMBER, BOARD OF DIRECTORS, ALASKA LEAGUE OF WOMEN VOTER'S

Ms. JUDAY. Alaska's clean air is recognized as one of its more valuable natural resources. We would like to keep it that way. We believe the Clean Air Act is important to maintain it. We do have some serious air quality problems here in Alaska. Some of this originates elsewhere; you've heard discussion about Arctic haze. Some of it is ice fog contributed largely from the automobiles. We must buy cars that meet national emission standards. Unlike California, Alaska does not constitute a large enough market to have its own standards. So we do rely on the protection offered by a national program.

To borrow from the poet and alter it slightly, no State is an island. Air pollution produced in one State affects its neighbors. Only a strong national program can protect this essential resource from degradation.

The League of Women Voters has several specific recommendations. We believe that the only basis for setting primary ambient air quality standards should be protection of public health. Basing the standards on economic considerations will weaken health protection and we oppose such a suggestion.

The standards serve two purposes. They protect people's health by serving as a major role of regulatory programs; and they are a yardstick against which the public can judge the success of a pollution control program and the quality of air. We do support consideration of cost as a tool for implementation of specific actions to meet the standards. Cost can be taken into account in setting pollution limits for individual industries. Congress can take cost into account in setting deadlines for areas too meet the standards. But cost should not be taken into account in setting the primary ambient air standards themselves.

The League of Women Voters supports deadlines for attainment of ambient air standards. Deadlines force action and allow the public to judge the effectiveness of clean air programs. Selected areas can be granted extensions if they are unable to meet deadlines, and this has occurred already.

The League of Women Voters supports an emission offset policy in nonattainment areas. This insures that total pollution is reduced as new growth occurs. It is a sound market mechanism for controlling air pollution. We've heard an example of an emission offset program with the pulp mill, the equipment installed on the third stack does allow the entire plant to meet the standards.

We do support automobile inspection and maintenance programs. The clean air benefits of these programs have been demonstrated. Current sanctions used to enforce implementation of these programs have been effective. And there is an added energy conservation benefit from the better gasoline mileage of well tuned engines.

The League of Women Voters supports the prevention of significant deterioration program. This program reduces the temptation for industry to move away from developed areas to avoid control requirements. This helps prevent economic dislocation. The program protects against adverse health and environmental effects which may occur even when standards are met. The program saves air resources for future growth.

We believe it is important to protect clean air areas. The standards of the Clean Air Act are based on a threshold level of exposure, below which it is presumed there are no harmful effects. In fact, no threshold level has been demonstrated. Many epidemiologists believe that the more we learn about air pollution, the more likely we are to identify adverse effects at lower concentrations.

The standards do not protect against derivative pollutants formed during interaction with other particles in the atmosphere. Neither do they account for the effects of exposure to multiple pollutants. There are all reasons to support strong protection in clean air areas provided by prevention of significant deterioration.

We do support increments as a tool in a form of budgeting the air resource available. The League of Women Voters supports significant reductions in pollutants which cause acid rain. The acid rain demonstrates the need for a national program. Individual State efforts to regulate air pollution have focused on reducing ground level pollution rather than total atmospheric pollution.

One method used has been taller smokestacks. The result is a shift in the problem to other areas in the form of acid rain. The problem is not only Canada's. Significant increases in acid rain have been recorded in areas as varied as the Colorado Rockies, northern Minnesota, the Ohio Valley, the Great Smokey Mountains, and Shennandoah National Park. Damage has occurred to lakes of the Adirondack regions in New York, agricultural crops in the Ohio Valley, property in industrial Midwestern and Eastern cities. And critical levels of acid have been reached in lakes in Minnesota and Maine.

The League of Women Voters would like a stepped-up schedule for regulating other toxic air pollutants. Curently the Clean Air Act focuses on controlling the seven most common and widespread pollutants. There are dozens of others. Many of these have serious health effects, and they are virtually unregulated. These pollutants need to be regulated.

We would also like to see a fine particulate standard rather than just total suspended particulates, because we believe the fine particulates are probably more harmful.

The Clean Air Act has been responsible for progress. Much remains to be done. We appreciate this opportunity to speak with you of our concerns. And our members across the country look forward to working with you.

Senator MURKOWSKI. Thank you very much, Ms. Juday. I think your observation that significant progress has been made as a consequence of the Clean Air Act is something that we would certainly agree with and needs constant reflection. Do you know if the league has taken any position on more flexible standards in the secondary area where there is no health hazard of any kind associated with the secondary standard?

Ms. JUDAY. I don't believe I can answer that question. Having only 1 week to prepare this, I've been unable to research this as thoroughly as I might.

Senator MURKOWSKI. I was interested in the comment that was made previously. And I noted that you were in the audience when Dr. Glenn Shaw suggested that perhaps in reality the ice fog, as it exists in Fairbanks, is a fortunate screen for pollutants. And I noted your comment on the ice fog and I wondered if in reality, while we're concerned about it because it's visible, that perhaps Dr. Shaw is correct and it's fortunate that we have it to screen the pollutants. Do you have any comment on that? I think we generally assume when there's ice fog that, well, Fairbanks is "heavily polluted." And according to Dr. Shaw, we may be fortunate that the ice bag exists.

Ms. JUDAY. Again, this is something the league does not have a specific position on. When we studied this issue we've looked at it from a national perspective. And our members in Alaska have looked at it with that perspective. I think we would be reluctant to see lots of individual exceptions being asked for individual States for the very reason that while Alaska's problems may be unique, that may be the basis for someone else asking for exceptions that may not be as well justified. We do tend to support on many of our positions that control the authority and responsibility for enforcement be at the level closest to the problem. And in that sense I think we would support some delegation of responsibility to States.

Senator MURKOWSKI. More State authority?

Ms. JUDAY. Perhaps, but the overall standards should be set at the national level.

Senator MURKOWSKI. Well, as has been pointed out and certainly occurs in the normal concern over the carbon monoxide emission from automobiles that the way to solve it is to require mandatory vehicle inspection. And if the State or local government didn't want to pass it on to the consumer, the cost of that, that was their own business. But it's been pointed out here in Fairbanks in 40° below zero weather, that isn't the problem. The problem is when you start up the vehicle and the technical capability to resolve that problem is nonexistent.

Ms. JUDAY. I think this is something that, in general, league has supported inspection and maintenance programs. And the difficulty we have seen elsewhere in the country is some governments are reluctant to impose these because they are somewhat unpopular. And yet in other areas they work very well. That may not be the best strategy in Alaska. And we would support some flexibility in determining the most appropriate strategy.

Senator MURKOWSKI. Well, the Chair certainly thanks you for your testimony. And I concur, in general. I would take one exception, and that is that the Chair also has poetic license and when you indicate that no State is an island, I would suggest that Hawaii may be an exception.

Ms. JUDAY. Yes, we understand.

Senator MURKOWSKI. With that we'll move on to Mr. Scott Ronzio, is that pronunciation correct?

Mr. RONZIO. Ronzio, sir.

Senator MURKOWSKI. Ronzio of ARCO, Alaska, also a corporation that has a substantial interest in our State. We welcome your participation in the hearing. And I'm sure Fairbanks' restaurants welcome you as well.

STATEMENT OF SCOTT RONZIO, SENIOR ENVIRONMENTAL COORDINATOR, ENVIRONMENTAL CONSERVATION DEPARTMENT, ARCO, ALASKA, INC.

Mr. RONZIO. Thank you, Senator. For the record, my name is Scott Ronzio. I'm senior environmental coordinator for our Environmental Conservation Department for ARCO Alaska, Inc. I'm here representing Mr. Robert Crosky, who's unable to make this meeting today.

Senator MURKOWSKI. Did his luggage get lost, too?

Mr. RONZIO. No, he's headed south, I think. He is vice president and manager of Alaska affairs for ARCO Alaska, Inc. I'm making this testimony on his behalf. I'm here also today on behalf of Atlantic Richfield Co. to share with you our concerns regarding the Clean Air Act and its effects on energy and mineral development activities in Alaska.

Our company is continuing to make substantial commitments in the State of Alaska. We are one of two operators at Prudhoe Bay. Sohio is our sister company along in that area; and are now developing the Kuparuk Field which is adjacent to Prudhoe Bay. Both of these are on the North Slope. We also have oil and gas operations onshore and offshore in upper Cook Inlet and have significant lease-hold interests in many other areas of Alaska, including the Gulf of Alaska, the lower Cook Inlet, the Beaufort Sea, and the North Slope. Our Anaconda subsidiary has significant mineral mining projects in process and in the planning stages within the State as well. In total, our past and potential future commitments in Alaska can be measured in the many billions of dollars. So we have a lot at stake.

In addition to our extensive Alaskan activities, Atlantic Richfield has considerable operations throughout the remainder of the United States which are also vitally affected by the Clean Air Act. As a result, many hours have been spent by experts throughout the company in developing an overall company position concerning the Clean Air Act reauthorization and reevaluation presently underway in Congress. A copy of this position paper I have attached to our testimony, and I'd like to make sure that that gets entered into the record, if I could.

Senator MURKOWSKI. That will be entered into the record. (See p. 1219.)

Mr. RONZIO. Thank you. Today I want to direct my remarks to two specific aspects of the present Federal clean air program, prevention of significant deterioration, PSD, and the recently promulgated visibility regulations with particular reference to our activities here in Alaska.

I'd like to discuss first our concerns with PSD. In general, it has been our experience that the complexities of the PSD program have forced us to divert considerable professional expertise into negotiating a maze of regulations rather than working to minimize potentially adverse environmental consequences of our projects in national ambient air quality standard attainment areas.

The costs to obtain Prudhoe Bay and Kuparuk PSD permits so far, as Sohio indicated, cost just about $2.5 million including the Kuparuk project. Not 1 cent of this cost has, in fact, been spent on actually maintaining or improving air quality, however. Instead, this $2.5 million was spent on required air quality modeling, ambient air monitoring, and other expenses associated with preparation of the PSD applications. We believe there has been no discernible benefit from this procedure, which has been to a large extent a very poor waste of time, talent, and money.

Furthermore, it is important to note that the long leadtime inherent in the PSD permitting process forces premature decision-making by us and other applicants including the specification of processes and equipment, which frequently have to be revised later as additional information is available.

Revisions in the scope and design of a project are quite normal, however, and these result from ongoing engineering design studies, changing operations, and field plans, equipment availability, as well as technological advancements. As a result, permits frequently have to be modified or new permits may be required. A specific example of this happened fairly recently at Prudhoe Bay where design studies indicated a requirement for a turbine mass mover, which originally was permitted for location in flow station 1; it actually needed to be located in another flow station some 4 miles away. This required a permit alteration, which essentially was handled by another PSD application.

In addition, each of these kinds of changes generally require further documentation and require computer modeling in order to evaluate the impact of these changes on air quality so as to enable the Environmental Proection Agency to reach a final decision on a new or modified permit.

The Waterflood project is another example of this tangle that we find ourselves getting into. A major modification of that PSD permit was required when we discovered that there was going to be some changes in the scope of that project. Initially, the water being injected into the oil bearing strata was to be heated to about 40° F. Under that scenario—that's the scenario we prepared for that PSD application.

With further engineering study, however, it was determined that we needed to actually heat that water to over 80° F. This required, therefore, more heating equipment than was originally planned.

The design change required extensive modification of the permit, including computer modeling and additional processes that added up to more than $30,000 spent. The permitting process under PSD is further complicated since prudent management is reluctant now to make sizable capital expenditures until all essential permits are obtained. If delays are encountered from new or modified permits, this process, at a worst case, could capture an otherwise acceptable project in a never ending cycle of permit modifications and delays. Luckily, to date, we have been fortunate here in Alaska that both the Alaska Department of Environmental Conservation and EPA in region 10 have fully cooperated, and we have had no delays.

We have a further concern regarding preconstruction ambient air quality monitoring requirements. Under the revised PSD regulations promulgated subsequent to the *Alabama Power* v. *Costle* court decision, 1 year ambient air monitoring representative of the year preceding the PSD application can be required by EPA. This requirement could be effective February 7, 1982.

Thus additional monitoring may be required for major modification of a source even if ambient air monitoring has already taken place. The benefit of this additional monitoring requirement is dubious in known pristine air areas such as the North Slope and other frontier areas of Alaska; and therefore serves only to increase costs and delay the development projects.

We Alaskans really do have a valuable resource in our clean air. And Atlantic Richfield continues to strongly support protection for human health and welfare as it may be affected by the quality of air resources in Alaska. But we believe it is in the national interest that the PSD permitting process be streamlined and simplified as set forth by our company position paper in detail so that needed energy and mineral development can proceed expeditiously.

In addition to the permitting process, the current PSD increment standards are, in fact, discriminatory because they subject Alaska and other attainment areas to——

Senator MURKOWSKI. They what Alaska?

Mr. RONZIO. They are discriminatory to Alaska and other clean air areas because they are unnecessarily stringent. The primary and secondary national ambient air quality standards were mandated to protect the public health and welfare with an adequate margin of safety. These standards prescribe uniform levels of air quality to be maintained throughout the United States. But the PSD increments are actually another layer of standards that disregards the adequate margin of safety already provided by the national ambient air quality standards for health and welfare protection. Thus, in areas such as Alaska that enjoy the clean air we are unfairly prohibited from the economic development by an air quality standard that in fact prohibits certain land uses.

In our view, since primary and secondary ambient air standards are already designed to protect public health and welfare, imposition of more standards to the PSD program does not have a reasonable relation to any known or anticipated risks of air pollution.

Finally, still with PSD, a major concern of our Anaconda subsidiary involves burdensome control requirements, specifically in the suspended particulate standard. As presently defined, the suspended particulate standard regulates both manmade and naturally occurring substances, dust, that carry no known adverse health effects as a class of contaminate. As a result, ordinary mine dust and haul road dust must be controlled at substantial cost without the resulting health benefits from that control.

And I will skip my summary statement. The second aspect of the Clean Air Act I wish to discuss is——

Senator MURKOWSKI. Do you care for your summary statement to be in the record?

Mr. RONZIO. I do, please.

Senator MURKOWSKI. It will be included in the record. (See p. 1209.)

Mr. RONZIO. The second aspect of the Clean Air Act I wish to discuss is section 169(A) of the act which declares that it is a national goal to prevent future and remedy any prior impairment to visibility caused by made-made air pollution in mandatory class I areas. Visibility is a natural resource worth protecting. The current regulatory program, however, contains several problems that should be resolved. Although to date the restrictions of our operations in Alaska due to visibility regulation has been minimal, the potential can be great.

In this regard, we should be clear to note that we are not impairing any of the visibility in any of the four mandatory class I areas listed for the State at this time. But if the integral vistas concept, if implemented, which has been proposed would extend these areas and essentially add a buffer zone to the clean air visibility aspect.

We believe there are three major problems that make it difficult to regulate visibility. First of all, it involves just understanding what visibility really is. There's no reliable measure of visibility or visibility impairment. The pleasure associated with a scenic view is something that we ourselves understand; it's the subject of the viewer. For this reason, it seems impractical to regulate the value of which is—regulate a resource, the value of which is aesthetic if the change in that resource cannot be detected by any standard method.

Second, it's not possible to quantify man-induced as distinct from naturally occurring visibility and impairment. And finally, the EPA has taken the position that localities outside mandatory class I areas should be subject to the national visibility goal. This position apparently conflicts with the existing statutory language.

If EPA is allowed to require the view from class I areas over outlying areas to be pristinely preserved, an implicit prohibition of all emissions affecting visibility as far as the eye could see could result. This could create the equivalent of a visibility buffer zone, which is strictly prohibited in the act.

To address properly the above concerns regarding recently promulgated visibility regulations, we'd like to recommend the following actions: One, that visibility regulations and subsequent guidelines from EPA be rescinded; that research into the science of visibility and the causes of visibility impairment should be accelerated; and finally, that visibility regulations should not include this integral vista concept.

In conclusion, we believe there are a number of specific areas in the Clean Air Act and its implementing regulations which should be modified to balance economic growth and resource development in particular, with protection for the Nation's clean air. We, again, encourage your careful consideration of Atlantic Richfield position paper attached which provides a more thorough review of each of these problem areas and recommends appropriate corrective action.

I'd like to personally thank Senator Murkowski for inviting Atlantic Richfield to this hearing.

Senator MURKOWSKI. Thank you, very much, Mr. Ronzio. We appreciate your testimony. I'm curious to know if Atlantic Richfield, ARCO, has had any difficulty in receiving permits under PSD or on visibility for any of your projects that you might have, not only in Alaska, but outside Alaska?

Mr. RONZIO. Gratefully, Senator, we can say that no, we have not.

Senator MURKOWSKI. OK, so you've been able to comply in all cases with the existing act?

Mr. RONZIO. That is right.

Senator MURKOWSKI. But your frustration is again in the interpretation of the act and, I assume, substantial time delays associated with it. One other question I had was I think you suggested that the act is somewhat discriminatory to Alaska based on the economics of what the consequences might be if the act were not as stringent as it is. My question to you, sir, is perhaps it is not in the best interest of Alaska, recognizing the specific uniqueness of our environment, as has been pointed out here in the testimony today, that maybe some of the blessings, if you want to call them blessings, that other States have received might have to be substituted for alternatives in Alaska because of the environment that we have?

Mr. RONZIO. I think it's a good point that you make. I knew you were going to ask me that when you asked it previously.

Senator MURKOWSKI. Well, you gave me the opportunity.

Mr. RONZIO. We feel that we'd like to develop whenever and wherever we can, obviously. Any impairment of the development is not certainly in our best interest as a company.

Senator MURKOWSKI. But you, of course, would agree that public health is a different matter?

Mr. RONZIO. Certainly. And just reiterating what I said earlier, we do have very clean air in Alaska, even though the scientists who testified earlier today did imply that it is dirty air up here. Actually, it is quite clean from our monitoring data, anyway.

Senator MURKOWSKI. I guess it depends on what you're monitoring, too.

Mr. RONZIO. Yes, it does.

Senator MURKOWSKI. If you know what you want to monitor or what to look for, it sounds to me like you'd find almost anything.

Mr. RONZIO. And we do have, as far as the air quality and the increment available to us on the North Slope for our developments, there's more than adequate air still available for future development. The comment, of course, was a general one. We have found ourselves in very, very tight constraints in our coal company developments in Wyoming.

Senator MURKOWSKI. Well, that's probably because you have too much sulfur in your Wyoming coal.

Mr. RONZIO. But as a general rule, we have been able to live with PSD, sometimes taking tremendous efforts on both EPA and our parts.

Senator MURKOWSKI. Thank you. I would thank all the members of the panel for their substantive input. And we're very appreciative. We have our final panel, now. After completion of this panel, we will be open to any public comment. The record will be kept open for at least 2 weeks for written statements and testimony. You may contact Mr. Jewett on my right, or Mr. DeVore on my left, who would be happy to accommodate you. The last four people who have given the committee notice of a request to testify are those as follows: Mr. E. W. Peters, a private citizen; Mr. Don Class of Shell Oil Co.; Mr. Dan Alex, vice president of Eklutna, Inc.; and Mr. Roger Burggraf, I assume, a private citizen?

Mr. Burggraf. That's right.

Senator Murkowski. And are there any others in the audience that would like to testify as well?

Unidentified Voice. I called in the other day, I guess I got lost.

Senator Murkowski. Well, if you got lost, you just got found, then. Would you give me your name, please?

Mr. Reichardt. My name is Paul Reichardt.

Senator Murkowski. Paul Reichardt. Paul, would you come up to the table, please, and state your association?

Mr. Reichardt. Fairbanks Environmental Center.

Senator Murkowski. Thank you, Paul. I think you were included earlier in the program, but let me see to make sure because I don't want to be accused of overlooking anybody. I'm told that you hadn't signed the guest register, yet. But, in any event, we apologize. And we didn't intentionally overlook you. Oh, we've got one other.

Unidentified Voice. Yeah, I'm not on the list to testify.

Senator Murkowski. Come on; introduce yourself.

Mr. Moyer. Thomas Moyer.

Senator Murkowski. Tom Moyer?

Mr. Moyer. With the department of environmental conservation.

Senator Murkowski. Both of you gentlemen are with Fairbanks Environmental Group?

Mr. Reichardt. Center, yes.

Senator Murkowski. Fairbanks Environmental Center. All right. Are there any others that would like to testify that we have not acknowledged that are not seated? If that is the case, then, the Chair will rule that unless someone comes in between now and the time that the panel will testify; then this will be the extent of the testimony at the Fairbanks hearing. I'm going to ask Mr. Peters on the end; Mr. Peters, it's a pleasure to welcome your participation in the Environment and Public Works Clean Air Act hearing in Fairbanks. And we welcome your testimony, sir.

STATEMENT OF E. W. PETERS

Mr. Peters. Thank you, Mr. Murkowski. I think it is very essential that we hand down to our descendants a clean and healthy Earth—or healthy planet Earth. And to do that, we have to make some sacrifices; that is, we have to deny ourselves. We have to deny ourselves such pollutants as the automobile. It sounds harsh, but we have endangered species now. And those endangered species can disappear altogether unless we do deny ourselves.

There is a reason for everything. Slavery; we had slavery. Of course, slavery was profitable. And we have pollution because it's just plain profitable to pollute; there's no other way. We have a throwaway economy because that is apparently profitable. If it weren't profitable, we wouldn't have that throwaway economy. Those bottles and cans would be recycled; it would go back again.

Well, that's just about it. It's just as plain as that; we have to deny ourselves. We just can't have the automobile unless we find a way of making it so it doesn't pollute. And I don't know what we're going to do about those jobs for those people that have to make the—who make the automobile. That is a very big thing, but I think they can be employed elsewhere.

And as far as handing down the Earth to our descendants in a healthy, unpolluted way, I think that is extremely important. And people who don't want it that way just plain have got to be sick people. I can't see any other alternative to it. And I'm open for questions, now, Senator.

Senator MURKOWSKI. Do you own an automobile, sir?

Mr. PETERS. Well, I used to. I don't anymore. I'm retired now. I still think, now, the train, river—water transportation is the cheapest. Even if the barge or the ship has to go against the current and make all those loops and everything, it still is cheaper than any other transportation. Next comes the train. The train is the next cheapest form of transportation. But roads, automobiles, those are the most expensive of all.

Senator MURKOWSKI. Mr. Peters, we appreciate your testimony. I would certainly concur with your comments with regard to disposable bottles and cans, and the sacrifice that we're going to have to be prepared to make to maintain a clean environment. And we thank you for your testimony.

Mr. PETERS. You're welcome, Senator.

Senator MURKOWSKI. You may continue to stay up with the panel if you wish, or you may go back in the audience. Whichever you would prefer, sir. I would call on Mr. Roger Burggraf. Roger, it's nice to have you with us. And we look forward to your testimony, sir.

STATEMENT OF ROGER BURGGRAF

Mr. BURGGRAF. Thank you, Senator Murkowski. It's a pleasure to be here. And I appreciate the opportunity to express my views. I'm Roger Burggraf, I live at 1.2 Mile St. Patrick's Road, Fairbanks. And I am engaged in exploration and development of mining properties in the interior of Alaska.

Basically, I am opposed to regulations. However, I do realize the necessity for regulations in situations where people can't regulate themselves. There's been a lot of good testimony today, and a lot of good points have been brought up.

I do enjoy hunting and fishing and outdoor activities, and I am concerned with the environment. However, I do realize the necessity for us to be productive in order to be able to survive in our environment.

My basic premise is that regulations, in order to be effective and to be—to do their job must be flexible; and this particular case, they must be tailored to meet the needs of the local areas. They should not be blanket that apply to all areas in the Nation. This is where we've gotten ourselves into some real problems, is that they have tried to apply standards to Alaska which do not—you know, which apply to the rest of the lower 48. In most cases—in many cases, they do not apply or do not effectively do the job.

So I don't believe in blanket regulations. Bob Hufman, of Golden Valley, expressed very well the problem that he is having in trying to meet the 70-percent sulfur—or the extraction of 70 percent of the sulfur from the low-sulfur coals in Alaska. This has cost the local area, the citizens of the State, of the interior, a considerable amount of money. It has cost the Nation billions of dollars because there are areas in the West where they are producing low-sulfur coal and they are having to comply with requirements that are set up to restrict the burning of high-sulfur coal in the East. And this is not right. It's very costly to our Nation. And hopefully, this Clean Air Act will be revised and certain modifications made.

This country has gotten itself so entangled with redtape that it's losing sight of its basic reason for existence, the survival of its people. Now, I'm not saying that we should disregard the air; it is very important for our survival. But there are also other things that have to be considered.

The basic intent of the Clean Air Act, I feel, was good. But like most laws or acts it has serious flaws which must be corrected. It needs to be overhauled. The regulations as they exist now are inflexible and result in a very high cost to the Nation and to its people in the loss of productivity or ability to compete with other nations; the loss of jobs. And this also has an effect on the health of the people. Sure, we don't want to breathe polluted air; that can affect our health. But if a man is out of work, that can have a very adverse effect upon himself as well as his family. So it's very essential, I feel, that we do create laws and regulations that we can live with.

And also it has brought about inflation, which is something that we've had some real problems in trying to overcome within recent years. I feel that the economic factors have been ignored in drafting this act and in enforcing it. They must be considered if the American people are to maintain a quality of life. Clean air is essential, but so is jobs. And they are necessary to pay for our everyday living.

The act must be made more flexible, and needs of the areas which are being monitored must be taken into consideration. Alaska has many unique problems. As was pointed out, I think by Dr. Shaw, he mentioned that most of our pollution is coming from the Soviet Union and other industrial areas. This is something that I was not aware of. And it is something that needs to be looked into. And it's—hopefully, the Federal Government is going to try to take steps to remedy this problem.

Other types of air pollution in the Fairbanks area are duststorms, which are winds coming off of the rivers and the deltas, also dust from roads. This has been brought out in other testimony. One source of air pollution that we haven't really talked too much today about is the forest fires that we've been having. This has been creating a lot of problems. And it's a natural form of pollution which we really don't have too much control over. I realize that, and I think our basic idea is to try to control that pollution that man creates.

The other point is there's been a lot of talk raised about wood-burning stoves. One of the reasons why many of us are going to wood-burning stoves is that the cost of energy is so tremendously high that we have no alternative if we're going to be able to survive. And in the Fairbanks area, it is a highly mineralized area. And the point that I want to bring out there is that the wood that is being burned in the area contains tars and it also contains heavy metals. And one of the techniques that I use in my exploration work is to take samples of leaves, of wood, and to have it analyzed to determine where ore bodies are. So some of your heavy metals are coming from the burning of wood.

Ice fog is a real problem, but as was mentioned here previously, it may have some beneficial effects as far as taking pollutents out of the air. So I don't know how we're going to come about that. Of course, the ideal thing is not to get any pollutants in the air. And I hope that this can be accomplished.

I would say the biggest means of reducing air pollution in Alaska and the United States is to reduce the costs of energy. I know if energy was cheap enough, a lot of people wouldn't be burning wood in the Fairbanks area because, let's face it, we're all by nature kind of lazy. And if it wasn't for the economic considerations, we probably wouldn't be out chasing around the woods cutting down trees.

So I feel energy is the key to development of low-cost energy that reduces pollution. Now, one of our best sources of energy which I cannot understand has not gotten off of the ground in Alaska is hydroelectric power. It's a renewable resource. Water is something that, you know, we don't use up. And why there has been so much static in the development of our hydroelectric energy sources, I don't know.

Coal, as has been pointed out, the coal that we have in Alaska may be a little bit lower in Btu's than other areas, but it is low in sulfur. It does not create as much in the way of pollutants in the air that are detrimental to health. Our oil is, of course, another source of energy.

In the early 1960's Golden Valley tried to promote the use of electricity for heating homes. This is—you know, I bet on that. And I was sorry that I did later on, but it was one of the cleanest sources of energy around. And it—I was really—felt badly that they were not able to continue their policy of selling electricity at lower rates. The reason why they couldn't sell electricity at lower rates, they have—we have plenty of resources; we have the Healy coal plant which has billions of tons of coal, which can provide low-cost energy. But the reason why electric rates have gone up is because of things like the Clean Air Act and the requirements there—they required millions of dollars of equipment that was not necessary to maintain the air standards.

And I am hopeful that in any future legislation or if this law is modified that it will allow for flexibility to provide economic and clean type of source of energy.

I think—well, I mentioned the reason for burning wood, and we're being forced into it. I like the smell of smoke, but evidentally there are indications that of wood smoke—there are indications that it could be detrimental to our health. I imagine that this is something that the university should go ahead and check on to find out actually how bad it is.

In closing I'd just like to mention that steps must be taken to realistically modify the Clean Air Act to allow the State to produce low-cost energy, which will not pollute the environment. I personally feel, you know, as I mentioned to you before, the Clean Air Act has—its intent was good. And there should be certain centers set up. But there should be flexibility in it, you know, so that the air can be monitored locally.

Thank you very much for the opportunity to testify.

Senator **Murkowski**. Thank you, Mr. Burggraf, for your testimony. I think that you have pointed out some rather interesting comparisons. I assume that you would be a follower perhaps of a generalization associated with a remark that President Reagan allegedly made that trees pollute when he was flying over a forest fire or some other thing. I would assume that the matter of the increase in wood burning stoves within the Fairbanks Valley area is something that is going to need to be examined and that you would be a proponent of the idea that perhaps we should trade off these resources that cause potentially higher pollution for others that cause less, but also have environmental consequences. And certainly, hydro development does have environmental consequences. But we do thank you for your testimony. I don't have any specific questions. What do you do as a consequence of the drop in the price of gold? You're in here today rather than out there, huh?

Mr. **Burgraff**. I think gold will maintain itself. It's dropping temporarily.

Senator **Murkowski**. I think so, too. I just wish I had some of it. OK, thank you, Roger. We're pleased to have with us Mr. Dan Alex, vice president of Eklutna Inc. Dan, welcome to the committee.

STATEMENT OF DAN ALEX, VICE PRESIDENT, EKLUTNA, INC.

Mr. **Alex**. Senator Murkowski, thank you for allowing me to make a presentation here in the hearing on the Clean Air Act.

There might be a question that might come to mind, why is Eklutna interested in the Clean Air Act? And I have a number of reasons why I am interested. Personally, as a citizen I see regulation, especially the amount of regulation coming from the Government, as having a hard cost to the public. And let me give you some examples of that.

For instance, regulation regarding, you know, water pollution. We're required to maintain an EPA permit for a treatment plant, yet nobody from EPA comes over to inspect to see if we are actually complying. As I see it, there's a regulation and a permit and a requirement to maintain a certain level of operation but without any monitoring. That costs money; getting a permit costs money.

Something that I've heard a number of times from time to time here today was the discussion that sulfur dioxide and nitrous oxide are harmful chemicals. We think about it in the building blocks of life, nitrogen and sulfur occur naturally; they wouldn't come into the air as a result of burning if they weren't a part of the building blocks of the coal or wood or oil or whatever.

Something else that I think hasn't been done is a study to see, you know, where those particular compounds sit within the life cycle. You know, I've heard a number of comments about acid rain. Well, acid is a reactive compound that helps break out other elements that would normally not be dissolvable. And in the life cycle, all of these things come the full circle.

One of the specific areas with respect to the Clean Air Act that I have some other concern about is in regards to the requirement for cleaning the air with respect to the automobile engine emissions and with respect to coal-fired plants. One of the things that would—the arbitrariness of the regulation makes it difficult at some point to reach the ability to meet the standard as required by the act. References were made by other people here today with respect to the western coal and the eastern coal. If you have a requirement to take 90 percent of the particulates out of the process of burning coal, it's probably considerably simpler than to remove 70 percent of a small amount. You know, it comes down to a technical impossibility.

Requirements with auto emission, I think, you know, it's reaching the point of the state of the art of not being able to go any further. And I get back to the point of what kinds of studies should be done with respect to the emission products of burning hyrdocarbons. Now, as I see it, these are part of the natural life cycle and obviously they were there before; they will continue to be there; and some way they get back into the system.

I do realize that there is a necessity for regulation where there's a considerable amount of pollution. But where pollution is not a problem that pollution might, in fact, be beneficial.

I just thought I'd go and bring up a couple of other items I was sitting here and thinking about with respect to the forest fires here in the Interior. The let-it-burn philosophy of the National Park Service and the let-it-burn attitude of the State department of natural resources probably violate the Federal Clean Air Act and the State of Alaska Clean Air Act.

Something else with respect to the forest fire, the forest fires have been shown in Alaska to be a natural phenomena in that they reintroduce nutrients back into the soil. One of the things that we've seen in fire burn areas is a significant increase in moose population. So obviously, there must be some beneficial byproducts of these burning. And that is my testimony.

Senator MURKOWSKI. Thank you, Mr. Alex. I'm not sure, but I believe that with regard to the forest fires and the obligation of the Federal Government and the State agencies to be responsive may have something to do with a determination of whether it's man-made or started from natural causes as to whether or not they're in violation or not in violation, but your point is still well taken; they still occur and there are benefits for some and losses for others depending on whether you're a tree or a moose.

Mr. ALEX. The let-it-burn philosophy probably would be the part where it would be in violation because if they let it burn, they have the ability to control it.

Senator MURKOWSKI. They might not have the money, though. One question of a serious nature with regard to the role that you see, and you've heard most of the testimony today so you're aware of the pros and cons of the Federal domination vis-a-vis more State control; and the recognition that in Alaska we do have unique circumstances but by the same token it's pretty hard to legislate exceptions which Washington traditionally hasn't done a very good job of doing for Alaska, and with that I'll ask your comments about how we create a harmonious area of responsibility toward our

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environment, ecology, and most of all our clean air; yet still recognize that there has to be some overall Federal coordination because some things are pretty hard to regulate on a State-by-State basis simply because they have an effect on another State?

Mr. ALEX. First of all, I think that there has to be a Federal baseline line and regulations which then the States could come into compliance with and in compliance with respect to their unique situations. You know, I was thinking with respect to burning coal in Alaska. Scrubbing the air with scrubbers may be beneficial to the air, but it concentrates the pollutant; then they have to get rid of the pollutant, which in a concentrated form is toxic but if dispersed may be beneficial.

Senator MURKOWSKI. Your dilemma is well presented, Mr. Alex. Thank you. I would now call on Mr. Don Glass of Shell Oil Co. Mr. Glass, it's a pleasure to have you before the committee today, and we welcome your participation in the hearing.

STATEMENT OF DONALD E. GLASS, MANAGER, COASTAL ENVIRONMENTAL ACTIVITIES, SHELL OIL CO, ANCHORAGE, ALASKA

Mr. GLASS. Thank you. My name again for the record is Don Glass. I'm the manager of coastal environmental activities for the Shell Oil Co. located in Anchorage. Both my company and I are grateful to you, Senator Murkowski, and to the Senate committee for providing us opportunity to submit Shell's views on needed changes to the Clean Air Act especially as reflected by our experiences with the act's limitation in Alaska in its offshore waters.

The Clean Air Act and most particularly its 1977 amendments has had both direct and indirect detrimental effects on Shell's Alaskan exploration and production activities. The direct effects stem from the act's provisions for the prevention of significant deterioration of air quality, about which we have already heard today a great deal and I won't add to that. The indirect effects arise from analogous PSD provisions contained in the Outer Continental Shelf Lands Act. Unless the PSD provisions of the Clean Air Act are changed, and the OCS Lands Act is reinterpreted, in our opinion, one must expect the type of effect I now shall describe will become more frequent and more acute as the tempo of oil and gas development increases in the Alaska area.

The OCS Lands Act mandates control of air emissions from offshore activities. The USGS and EPA have used this mandate to impose emission limitations on all offshore petroleum extraction industry operations. The USGS air regulations are patterned after the Clean Air Act regulations, they're the root of the problem. They include emissions impact analysis, best available control technology [BACT]; and postinstallation emission monitoring. These terms are taken from the Air Act's PSD requirements.

Currently Shell Oil Co. is preparing an application to drill an exploratory well on a gravel island in the Beaufort Sea. That location will be about 18 miles east of Prudhoe Bay and 5.1 miles from land. For this activity, we must satisfy the emissions impact analysis provisions of the air regulations. The U.S. Geological Survey provides two methods to satisfy the analysis provision. First, an exemption is provided in the form of a formula which connects the maximum allowable exemption in tons per year with the distance between the source and the shoreline. Failing this exemption test, overwater modelling is required.

The intially proposed formula—and I won't burden you with these formulas; they'll be in the written submission that we will make and like to include in the record.

Senator MURKOWSKI. It's so included in the record. (See p. 1239.)

Mr. GLASS. The initially proposed formula for exemption was submitted by industry and it was based on worst-case meteorological data found in the east coast, the gulf coast, the west coast, and the Alaska OCS areas. Additionally, the models used by industry were EPA approved models, which incorporate a safety factor conservatively estimated to be about 250 percent, a very conservative basis. The USGS, with advice from the EPA, rejected the industry proposal in favor of a similar but more severe formula, essentially three times that severe.

The Agency's formula, in effect, exempts a 100-ton-per-year source at 3 miles from shore. Interestingly, this is identical to the Air Act's definition for an onshore major stationary source located in a nonattainment area. The USGS did not justify its exemption formula when the OCS air regulations were promulgated. It appears that the USGS manipulated its formula to force an emission source lying 3 miles offshore to meet the same emission limitations as required by the EPA for a source in the center of a nonattainment area.

The result is that Shell will be ineligible for the exemption at the aforementioned offshore well because the estimated emissions exceed the exemption threshold. And just to quickly run through those numbers, the threshold according to the USGS formula for our location would be 170 tons per year; according to the industry-proposed formula, the number would be 408 tons per year; and the estimated emissions from our offshore activity are 205 tons per year.

Senator MURKOWSKI. Does that meet the State requirements?

Mr. GLASS. Yes;

Senator MURKOWSKI. In this case, but it does not meet the requirements of EPA?

Mr. GLASS. It does not meet the requirements of the USGS borrowed from the Environmental Protection Agency, yes.

Senator MURKOWSKI. OK.

Mr. GLASS. Consequently, Shell now must perform site-specific overwater modeling, which is both time consuming and costly. Had the USGS used the industry—proposed formula which we believe to be realistic and appropriate, the well would have been exempted from the emission impact analysis.

Modeling requires site-specific meterorological data. Offshore data of sufficient detail to satisfy the modeling requirements are not presently available in the Beaufort Sea. So onshore data must be extrapolated to offshore situations. This extrapolation tends to indicate a worse emissions effect than if actual offshore data were available and used. Thus, we will be penalized because of lack of suitable data first, and because the time necessary to perform the modeling. Experience shows at least 150 days are required to secure a modeling contractor, gather the necessary data for extrapolation, perform the modeling, prepare the result in the detail required under the Clean Air Act and submit the report. With the already abbreviated drilling season in effect on this well, this effort could set back exploratory drilling as much as an entire year. And if some of the onshore experiences are carried out, it can be longer than that.

Other delays and costs will stem from the need for Shell and the regulatory agency to agree upon what controls satisfy the BACT requirement and to implement an emissions monitoring program.

As a result of Shell's experience with the Clean Air Act as it has been implemented in Alaska, we believe that Congress should reexamine the act's statutory PSD program and the corollary OCS requirements. Such re-examination might legitimately focus on whether the clean air benefits originally anticipated by Congress to flow from the PSD program are real or an illusion; and whether or not the delays and incrementally higher costs which inhibit Alaskan OCS oil and gas development, are an acceptable price to pay.

For onshore purposes, we believe that a combination of BACT and protection of national secondary standards is a simpler alternative to PSD and one which would afford adequate protection to air quality over both Alaska and the lower 48. For offshore purposes, we believe that as the distance from a shoreline increases, the stringency of emission controls legitimately can be decreased without adverse effects onshore and that the USGS formula doesn't adequately describe the situation.

In a larger sense, and based upon our experiences in the lower 48, we've made a dedicated and concientious effort to examine ways by which the present Clean Air Act might be revised to make it more workable without jeopardizing its laudable environmental goals. The result of our effort is summarized in the attachment to our statement being submitted for the record. And as I've already stated, we'll put that in the record. But I would like to briefly refer to a couple of parts of that because I think they bear importantly on the summary which I would like to make orally at this point.

Senator MURKOWSKI. Please go ahead, Mr. Glass.

Mr. GLASS. Referring first to our position paper and dropping down to a section headed "1970 and 1977 Amendments, What Went Wrong." From the title of this paragraph an unwary reader might infer that the Clean Air Act amendments of 1970 and 1977 proved to be failures. It is not the purpose of this paragraph to convey that impressions, however. The 1970 amendments, by design, represented a pioneering piece of legislation which embodies a discontinuity, a substantial departure from the previous evolution of Federal laws concerned with air pollution abatement, an intentional departure. Since the 1970 amendments were intended to require significant divergences from earlier approaches it is a credit to its draftsmen that the experience since then generally demonstrate that the act was successful and usually workable. The 1970 and 1977 amendments have produced changes and significant progress has been made toward achieving improved atmospheric quality in many parts of the Nation. Despite the successes of those amendments, however, they're not perfect. Some of their provisions have not withstood the tests of practicality and cost effectiveness. And we would like to explore a couple of those.

Before doing so, however, some representatives of some segments of our society would allege that industry seeks to gut the Clean Air Act. Other segments of society assert that more modest changes are needed to make the act more workable. And Shell would agree with the latter camp; we need to make changes to make it workable. We've had more than 10 years of experience working under the act. In that time, we've learned a great deal about the sources, the atmospheric chemistry, the fate and effects of atmospheric pollution. We've also come to appreciate that air pollution is not the Nation's only major problem and that all of the Nation's problems can't be resolved simultaneously. We've come to appreciate the fact that our resources, although large, are finite. Therefore, it is essential that we prioritize our Nation's needs and attack our problems in a rational and orderly procedure.

With respect to the degree of health protection required, among the stated purposes of the act is to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population. And a specific mandate from Congress in the 1970 amendments was a requirement for the attainment and maintenance of standards, which, in the judgment of the administrator, allowing an adequate margin of safety, are requisite to protect public health. Public health was nowhere defined, nor was adequate margin of safety. Hence, EPA wrote its own definitions. And in their interpretation, it is their mandate to protect all of the people all of the time from all airborne health threats. Furthermore, the EPA views it as their duty to insure that no present exposure to any airborne pollutant shall leave any individual more susceptible to any disease at any future time.

This is a zero risk approach, and because it is zero risk, it is impossible to attain. Advances in analytical procedures and in epidemiology make it certain that somewhere someone will be found who is affected by levels of airborne materials previously thought to be without effect. Hence, society is faced with changing targets which remain unattainable. Perhaps no one summarized it better than William Ruckelshaus soon after leaving his post as EPA administrator when he had this to say:

> We have made a mistake in setting for ourselves goals that are essentially unachievable. If we took every dollar in the Nation and every technological capacity we have and devoted it solely to the protection of air, we still would not achieve the goal.

We believe that Congress should define precisely what its intent was in 1970. Such an expression would make it unnecessary for EPA to develop unilateral interpretations of Congressional language and intent.

In addition, EPA's implementation procedures for developing the national ambient air quality standards are flawed. In developing the criteria documents which serve as the foundation for NAAQS, the agency has been content with a noncritical literature review. This practice involves collecting all published literature on a given topic and accepting all of it at face value without attempting to evaluate the reliability, the age, or the source of the document. Under this procedure, national ambient air quality standards invariably emerge as worst-case limits. In addition, the EPA confuses measurable effect with adverse effect. In several instances low airborne concentrations of a given material can produce measurable effects in some physiological parameter. The agency then assumes that any measurable effect is adverse.

We recommend, therefore, that the words of the Clean Air Act include explicit requirements that national ambient air quality standards be set at levels which are free of unreasonable risk to public health.

The legislative history of the Clean Air Act amendments of 1970 indicates clearly that Congress intended for EPA to ignore economic factors during its process of setting national ambient air quality standards. In essence, Congress said let there be clean air by date certain regardless of the cost.

Shell believes that economic factors and social consequences are factors which must be considered during the national ambient air quality standard setting process. We believe that the amendments to the Clean Air Act should explicitly require EPA to consider them.

Senator MURKOWSKI. Might I ask you to summarize your remarks, please, Mr. Glass.

Mr. GLASS. Yes, I'll do that, Senator. My written statement contains additional material on the PSD concept, but I don't think it's anything you haven't already seen. We also feel that the schedules and timetables ought to be removed from the Clean Air Act. These were placed, we believe, by a Congress that was making an emotional response to a lack of obvious progress. And we think the times have changed to a point where there should be more flexiblity in that.

In summary, we feel that economic factors and social consequences should be included among the factors to be considered by the EPA in setting or revising national ambient air quality standards. We think EPA should be required to consider all scientific data relevant to a given topic, but that information should be subjected to a searching peer review process.

We feel that deadlines should be removed from the act, and that in their place the EPA should be granted discretion to pursue targets at the earliest practicable date. And we would repeat the thoughts of others expressed today that the acid rain problem really needs a lot more study before regulations should be promulgated in that area.

We, too, have reservations about the inspection and maintenance program. And we particularly feel that if certain nonattainment areas are to have a ban imposed because of the State's failure to have an inspection and maintenance program, that the statutory ban on construction of stationary sources should be removed. Thank you very much.

Senator MURKOWSKI. Thank you, Mr. Glass. I might just pass on for your consideration a concern that was expressed in Seattle by a representative of the Governor's Office in Washington, he suggested that, in its ultimate wisdom—and he generalized in that term—that in reality what the Congress of the United States has done is taken away the responsibility of the States to impart some flexibility because—to quote their statement—"the Federal Government doesn't trust the States." And I wondered if, in your analysis of the way the regulations are promulgated, you feel that the States should have a greater degree of flexibility. Or if not the State, a region that has a common set of circumstances.

Mr. Glass. In general, we feel that it would be desirable for the States to have greater exercise of flexibility over the Clean Air Act. In a large State like Alaska, perhaps even a region. Looking at the problem nationally, however, I think we would all have to agree that there are necessities for national standards. And we have no more argument with standards which are truly related to health than anybody else that's spoken here today. We do think, though, that those standards have been based, in many instances, on faulty information or faulty perceptions of data.

I was deeply involved in this in the early 1970's. And many of the early ambient air standards could not be measured by practical instrumentation available at that date. So we do think that there needs to be a national standard. We think that the numbers that have been selected need to be reviewed.

Senator Murkowski. Let me ask you one more question, Mr. Glass. You suggested that in your development project, the relationship between the interpretation of USGS's application on the EPA regs took them to a more extreme level. I assume you confronted USGS with at least your situation from your point of view and they were not sympathetic. And I'm wondering what course of action, if any, was available to you as an alternative?

Mr. Glass. We did that.

Senator Murkowski. The answer was no?

Mr. Glass. The Lord answers all prayers. It seemed to us that Congress clearly delineated between control of onshore emissions and offshore emissions in the manner in which they set up the provisions for offshore control and the OCS Lands Act amendments. So there was a good argument. We felt that onshore limitations should not simply be extended offshore. However, people borrow and it was almost inevitable, I suppose, that USGS would lean to the extent that they did on EPA. Whether that is proper or not is a matter of perspective. We would hope that in time and with greater opportunity to look at the situation that USGS might modify its position. But the root of that problem is clearly in the PSD provisions of the Clean Air Act. And solving that root would solve both problems. From a practical point of view, that might be the best solution all around.

Senator Murkowski. Thank you; thank you, Mr. Glass. We appreciate the testimony which you have submitted and the material that you were unable to read will be contained in the record. Before we move on to our last two witnesses, I would like to recognize an old friend of mine, Mr. J. P. Jones, a long-time head of the NAACP in Fairbanks and an outstanding community leader. It's nice to have you with us, J. P.

Mr. Jones. Thank you, Senator. And while you're talking about me, I want to report one thing. We just had a cross burning in our neighborhood.

Senator Murkowski. A what?

Mr. Jones. Cross burning.

Senator Murkowski. Is that right?

Mr. Jones. That's right.

Senator MURKOWSKI. Well, you and I will talk about that later.

Mr. JONES. I just wanted to bring it to your attention.

Senator MURKOWSKI. I appreciate you mentioning it. I'm sorry to hear that.

Mr. JONES. All right. Thank you.

Senator MURKOWSKI. You bet. We'll move on to Mr. Paul Reichardt, the Fairbanks Environmental Center. And Paul, it's a pleasure to have you with us. We look forward to your testimony, sir.

STATEMENT OF PAUL B. REICHARDT, CHEMIST, UNIVERSITY OF ALASKA, REPRESENTING THE FAIRBANKS ENVIRONMENTAL CENTER

Mr. REICHARDT. Thank you. I'm Paul Reichardt, a chemist at the University of Alaska. I've done a bit of research on the air quality in Fairbanks and I'm submitting testimony based on my research experience at the request of the Fairbanks Environmental Center.

When viewed in context, I believe the Clean air Act is one of the most important pieces of legislation ever passed by Congress. It is a start, an imperfect one to be sure, toward dealing with what could become one of the greatest dangers posed to our technological society. While the act is in need of revision, I strongly oppose the view that it should be gutted or allowed to lapse. Communities everywhere, and Fairbanks in particular, need a set of bottom line Federal air quality regulations. They should provide the basis on which local government may build to address air quality problems of local importance. Turning the entire process over to local authorities, however, has the potential for bringing inordinate political pressure to the officials charged with protecting air quality when compliance problems develop. We have already seen improvements in Fairbanks' air quality because the EPA was willing to hold the line and force our reluctant local government down the road to compliance.

We need scientifically based Federal standards for both overall air quality and for source emissions. The Fairbanks situation clearly demonstrates why both are needed. As far as I know, every study of Fairbanks' air problems has indicted the automobile as the principal source of air pollutants. The origin of the problem makes it very difficult to control emissions at source even though we have emission control devices and voluntary inspection programs. The only practical way to control this type of pollution seems to be attaining area-wide air quality standards by modifying traffic patterns. However, given the fact that we often have poor air quality in town, we must attempt to control source emissions where practical. Thus, stationary significant sources of air pollutants must be controlled in order for the community to benefit from improvements obtained from the program which deals with vehicular emissions.

One aspect of source emission control which seems to me in need of modification is the sulfur oxide situation. Our goal should be to set some limit for sulfur oxide emission from powerplant stacks. If the local utilities can burn coal and meet the emission standards without scrubbing, they should be allowed to do so while at the same time dealing with other emissions such as particulates.

I think that, in general, revision of the Clean Air Act needs to address two issues: streamlining procedures and setting new standards where called for by data gathered since the passage of the act. I'm sure that the utilities and industries involved can suggest reasonable streamlining; and indeed, we've heard some of that today.

My suggestion on new standards is basically to set them conservatively based upon the best scientific data available today. the question of the relationship between levels of air pollution and human health is tricky business, and there are legitimate differences of opinion on the matter. I urge you to take the chance of erring on the side of safety when you set them. Traditional cost benefit analysis has no place in guaranteeing clean air for the inhabitants of Fairbanks or anyplace else. We must be sensitive to the special problems of the young and the ill. Life, liberty, and the pursuit of happiness are not the exclusive purview of the physically fit.

Senator MURKOWSKI. Thank you, Mr. Reichardt, for that precise statement. One question: You indicated in your comments that we should look to the existing coal-fired generation plants for a reduction in emissions of pollutants. In view of the requirements of the act which seem to relate to the allowable percentiles of sulfur in coal and the requirements that 70 percent of the sulfur be removed; and we assume that it was primarily needed in the more populated areas where they have higher sulfur coal than we have in Alaska—somewhere between 3 and 5 percent and ours is 0.25—can you suggest any particular relaxation or equalized proposal for Alaska coal as an alternative?

Mr. REICHARDT. Well, I think that what we will find is that it's very difficult to control at source any type of individual emissions. So whether I drive my automobile or heat my home with electricity or heat it with wood, or coal, or whatever it is something that I think is just beyond control.

Senator MURKOWSKI. Yes, but the problem is we have is that elected officials are expected to go back and provide some kind of control. And it's very difficult to do that because regardless of what action you take, it is going to have an environmental impact of some kind and——

Mr. REICHARDT. That's right. But I think we've seen in Fairbanks that the effect—or a way to approach the program with the carbon monoxide level; that is, it was recognized that—in particular, that the people of Fairbanks, having the personalities we do, are less prone to some sort of inspection method than to alternatives. And so the business of one-way streets and trying to address traffic flow was a way to approach things.

Senator MURKOWSKI. Yes, it didn't necessarily cut down on the monoxide but it dispersed it more, so it wasn't an identifiable problem on one particular corner.

Mr. REICHARDT. That's right, but that's a scientifically sound solution, I think, because at some level carbon monoxide begins to have an effect. And I think that——

Senator MURKOWSKI. But we haven't been able to determine how to reduce it when it really is producing, and that's during the cold start.

Mr. **Reichardt**. That's very true. Although by eliminating some of the other marginal additions of carbon monoxide, we are able then to get down to what's accepted as a safe level except in some situations we haven't quite been able to deal with yet.

Senator **Murkowski**. Well, most of the testimony today has indicated that the real problem is not whether your catalytic converter is working efficiently. It's caused when that car is cold and that engine started the first few minutes. That is the real problem. Now, I——

Mr. **Reichardt**. That's true. If we're looking at, say, reducing our carbon monoxide levels by another factor of 2 or a factor of 10, that's true. We have to get around that. But the point that I was trying to make in my testimony with respect to the stationary sources is that if we view, let's say particulate matter; the particulate matter put by automobiles and put out by the MUS stack is very similar. So it doesn't do us any good to attack the particulate matter coming from mobile sources without having some way to also control what goes on in the MUS stacks. Because if there's no control over those emissions, it may well be for economic reasons it now is convenient for them to fill up the gap that we just produced by regulating the mobile emissions. And that's why I think we need to have both kinds of standards. And it's clear that one is very easy to regulate, maybe not easy to meet the regulations, but one is easy to regulate and the other one is very, very difficult. And my testimony and also the previous testimony from the representative of Shell dealt with this business of modifying the standards. And, you know, we both alluded to the fact that there's a difficult-to-see relationship between the level of a pollutant and its effect on health. And somehow I think Congress is going to have to deal with that because some numbers go into either the legislation or the EPA regulations. And I might suggest the National Academy of Sciences as a body that would be extremely helpful in setting standards.

Senator **Murkowski**. That's an excellent suggestion, Mr. Reichardt. That will be so noted in the record, your suggestion of the National Academy of Sciences. Thank you. I would call on Mr. Tom Moyer of the Fairbanks Environmental Center.

Mr. **Moyer**. No, for the record, my name is Thomas Moyer. I'm an air quality planner for the Alaska Department of Environmental Conservation.

Senator **Murkowski**. Thank you, Tom, and excuse me. Please go ahead with your testimony.

STATEMENT OF THOMAS E. MOYER, AIR QUALITY PLANNER, ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Mr. **Moyer**. OK. Thank you for letting me be a late addition to the testimony. In light of that I'll keep my comments brief and to the point. And they mainly regard mobile sources and clarifying some statements on the issues made earlier.

Senator **Murkowski**. Excuse me, if I may I would remind you that this particular hearing is not an adversary hearing where we're not interested in challenging anyone else's statements. You may proceed with any statements of your own, but I wanted to make sure that the ground rules were understood.

Mr. **Moyer**. No. I don't intend to challenge anyone, just to add some new information.

Senator **Murkowski**. Sure.

Mr. **Moyer**. Concerning the control technology for cold starts, which we were just talking about a little bit, and ice fog, there are certain technological ways of controlling cold-start emissions. But they have mainly have been applied hit-or-miss in the auto industry, mainly because there has been no incentive to them to apply them, no cold-start standard or cold temperature auto standard. And no technological fix will eliminate cold-start emissons but just reduce them. For example, there are certain foreign design engines that just do better on cold starts than certain American ones due to inherent engine design.

Noncarbureted vehicles, diesels, fuel-injected, are cleaner cold starting than most carbureted cars. Alternate fuels, the use of alcohol fuels reduces not only warm idle emissions but cold-start emissions, too. I would hope the Clean Air Act would look favorably upon any alternate fuel that could reduce emissions.

Our department has been in contact with the auto manufacturers. And sometime probably in mid-July we'll be meeting with some of the manufacturers from the auto industry to discuss ways of reducing cold-start emissions. And one obvious way everyone in Alaska uses is a preheater which simply eliminates the cold start. And that also has an effect on ice fog. Not to cloud the issue any further on ice fog, but I want to make it clear that high levels of CO that surpass the standard and ice fog occurrences are just about mutually exclusive. By the time the temperature is cold enough for an ice fog occurrence to come on, let's say 30 below or colder, rarely do we have CO violations. And one of the biggest reasons problably is that there are frewer or no cold starts. Because if you're not plugged in by 30 below, you're not going to start at all.

Senator **Murkowski**. That's a good point.

Mr. **Moyer**. At such times we confuse ice fog and CO, and I'm not talking about the unregulated pollutants that Dr. Gosink was speaking of earlier, but carbon monoxide usually does not occur when we have ice fog in high levels. That's mainly what I'd like to say. I discussed earlier with Commissioner Mueller about perhaps adding some additional written comments if we think it necessary to just clear up some other areas. If we decide to do that, we'll get it to you within the 2 weeks.

Senator **Murkowski**. Mr. Moyer, I very much appreciate that. We would be happy to include anything you would care to submit for the record. I think it was particularly interesting to note your comments that you are working with some of the automobile manufacturers to direct their attention to the cold starts. It's always occurred to me that in the Northern States, such as Minnesota and Illinois and Michigan that, you know, they must have a similar concern. But I guess that last 20° that we get just makes all of the difference in the world. And it's noticeable not just in the area of concern about emissions, but even in that steering wheels will crack and all kinds of things have happened to your car when it's 40° below that obviously when they mass produce them in the United States, they just don't gear them for the testing that occurs in severe climatic conditions that we have for 3 to 6 to 8 weeks during the wintertime. But it would seem to me that you have also brought up a very interesting point and you're the only one that's done so. And we've heard a lot of testimony about the problem associated with the carbon monoxide initially on the cold start; and your contention if it gets that cold it's not going to start anyway unless you've got it plugged in. And we haven't heard anything to refute that. Would any of the panel members like to comment?

Mr. Moyer. If I could further point out that the use of preheaters varies according to temperature. At 25° below everyone is using them or you will not start. At 20° above, when you can still have a significant cold-start emission, there's a significant number of people who don't use them. And therefore, there are plenty of cold starts taking place and resulting high CO levels.

Senator Murkowski. Yes, Mr. Alex.

Mr. Alex. I'm just going to say that I think it's a problem that's technically solvable because carbon monoxide is simply carbon and oxygen minus 1 oxygen atom. I was going to say the incentive for the industry is not to solve Alaska's cold start problem or carbon monoxide problem. Maybe it would be in order for Alaska to go and look at paying for some investigations for solving that unique problem.

Senator Murkowski. That's a good suggestion. I'd like to thank the members of the panel. Go ahead, Mr. Alex.

Mr. Alex. I wanted to say, I will submit written prepared testimony. In coming up here, I didn't have time to prepare a polished written presentation. I will, and I have one question. A friend of mine——

Senator Murkowski. I don't know if the questions go both ways, but go ahead and try me.

Mr. Alex. Well, the question is with respect to a friend of mine who is a professional engineer who designed one of the last steamplants, I guess, built in Alaska. And he gave me a paper, but I don't think it's tailored to this hearing. And what I'm asking is, can he provide a technical paper regarding the Clean Air Act and coal and emissions for the record?

Senator Murkowski. Yes, we would welcome that. And he may submit it to my office at his convenience within the next 2 weeks.

Mr. Alex. OK.

Senator Murkowski. That would be appreciated. I would like to thank the members of the final panel. I assume that we have not overlooked anyone wishing to provide testimony with regard to the Clean Air Act.

In summary, I think we're generally in agreement that we have a very complex set of regulations here. Mr. Mueller indicated that he, as well as other experts who work with him, do not have a total comprehension of them. I think that the point that was brought out on the Alaska coal at 0.25 percent sulfur vis-a-vis the eastern coal at 3 to 5 percent, yet the requirement that 70 percent of the sulfur be removed is something that should be given consideration when we examine the record and begin to develop whatever regulatory changes or legislation which ultimately goes into the revision of the Clean Air Act, that there certainly is an inequity there. I think the presentation on the Arctic pollution was stimulating and shows, again, a greater need for a coordinated effort internationally on the Arctic. And the point was also well made with regard to the attention that Antarctica gets, not only in funding, but in research. In the Arctic we're not doing it, and it's extremely unfortunate. And we've got to do a job and designate a Government agency who will fulfill the Federal responsibility.

I think we've also seen in the just concluded discussion about auto emissions in the interior, Anchorage and Fairbanks, and the problems associated thereof; and the probable lack of effectiveness of mandatory inspection and maintenance as far as achieving a reduction of carbon monoxide. We've had an interesting discussion about the ice fog and the filter effect that it has; and whether or not it is a pollutant in the manner in which we generally assume it to be because it's so visible; and the growing concern over the utilization of wood-fired stoves; and the alternatives of coal and hydro. We've had a good discussion of State and Federal authority and roles. The acid rain matter has been brought out as one needing greater attention and understanding; yet recognition that it is very much of a growing problem I think particularly the testimony with regard to the streamlining and processing of permits is one that we'll certainly give attention to. I don't think it should be necessary for Federal law to be so complex as to require the retention of high-cost consultants in order to process applications.

I do think overall that the hearing has shown a uniform and genuine concern for clean air and better health. And I assure those of you who are still with us that it's not the intent of the Congress of the United States or the members of the Environment and Public Works Committee to see the act gutted, or to see the act lapse. With that, I would again thank you for the submission of your testimony for the record. Those of you who would like to receive a copy of the testimony that was given here today, it will be made available through our office. Mrs. Marcia Kozie over here is my—would you stand up, Marcia—is my special representative in Fairbanks. I don't have any idea, do you Jon, on how long this testimony usually takes to transcribe? It's sent back to Washington and submitted to the committee—you think the application time's tough for these permits.

Mr. JEWETT. It varies a good bit because we've had so many hearings.

Senator MURKOWSKI. That's a good answer as a start now, but when do we get it?

Mr. JEWETT. I would say that the final published record will probably not be available for a good 3 to 6 months. Now, portions of the transcript can be made available sooner.

Senator MURKOWSKI. OK. Well, with that, we'll do the best we can. Those of you who would like to have copies, we will make them available. With that, I would conclude the hearing but keep the record open for another 2 weeks from today. Again, thank you. It was a pleasure for me and Jon Jewett and Jon DeVore to hold this hearing in Fairbanks. And I might just add that there were some strong suggestions that it be held in Anchorage. The only thing that prevailed was my residency in Fairbanks. And with that we'll conclude the hearing. Thank you.

[Whereupon the hearing was adjourned to reconvene at the call of the Chair.]

[Statements submitted for the record follow:]

TESTIMONY ON REAUTHORIZATION OF THE CLEAN AIR ACT

by

Glenn E. Shaw
Professor of Geophysics
Geophysical Institute
University of Alaska
Fairbanks, Alaska 99701

Scope of this testimony

My professional credentials are in the area of physics and chemistry of the atmosphere. I teach atmospheric physics and astronomy and I have authored nearly one hundred technical papers, mostly on the subject of air contaminants in the atmosphere at locations far from human habitation: Antarctica, northern Alaska and the central Pacific ocean. My exposure to problems of air pollution on global and semi-global scales prompts me to provide this testimony, which will be devoted mainly to Alaskan air pollution problems. In addition, however, there are a few places where I know that alterations should be made in existing legislation pertaining to the maximum possible exposure to certain chemical compounds, so I will devote some attention to these areas also. I will try and remain within my professional constraints in providing this testimony.

Total Suspended Particulates

The present regulations on total suspended particulates is poorly formulated. Changes are needed in the basic unit; presently the regulation is expressed as maximum mass loading, commonly expressed in micrograms per cubic meter. While such a definition is sometimes reasonable to use as a gauge of pollution, there are often occasions where industry pays unreasonable costs to meet the regulation because of special conditions. For example, the TSP is high at Fairbanks in summer because of wind-whipped fine particles of dust from local loess deposits and the TSP is abnormally high in the deserts of the country where natural dust is included with industrial pollutants. The TSP can also be abnormally large in coastal communities due to the presence of sea salt particles generated by breaking waves in the ocean.

I would recommend that the TSP index be replaced with an index to regulate particles in roughly the size range 0.1 to 1.0 micrometers radius because these particles penetrate deepest into the lung where they can attach and cause health problems. The particle size just mentioned is also the size where most industrial pollutants are found. In addition to modifying the law to take into account particle size, the regulation should be modified to incorporate particle composition. Particles of compounds containing lead, mercury, arsenic, selenium, cadmium and other toxic substances should be more tightly controlled than particles composed of, say, sea salt material or naturally-occuring crustal material.

In considering changes to the regulation on TSP, one should be aware that there have been considerable technological advances since the passage of the clean air laws in 1975. There are, for instance, facilities at many universities and research laboratories that can sort particles by size and classify them according to elemental composition. It would be unwise to unfairly penalize industry by holding them accountable for emitting compounds which may not be dangerous and which may not represent visibility reductions. In general, health problems would be better served and industry would be better served by introducing alterations into the regulation on TSP. I would recommend, however, that before changing the law the federal government may want to establish an expert panel to make ad hoc recommendations on research which may be necessary on certain aspects of particulate air pollution. A serious effort should be devoted to changing the particulate pollution regulations to reflect the best current state of knowledge about health hazards from various types and classes of particles.

Acid Rain

Acid rain comes mainly from converted sulfur gases emitted by heavy industry and power plants. It is a problem that presently affects the northeastern United States, continental locations in the Soviet Union, Japan and several high latitude regions like Scandanavia and Canada. Fortunately there are now fairly substantial research projects underway to evaluate the impact that acid rain has on the ecosystem. These research projects are extremely important and should be continued long enough to be able to arrive at a consensus of opinion as to what steps should be taken to control acid rain.

One problem that must be investigated is the geographic scope of the acid rain problem and its alterations which have come about or which could come about due to industry constructing higher emission stacks. One way that industry has responded to cleaning the environment to come into compliance with the clean air act has been to inject pollutants at higher altitudes. This indeed cleans up the area around the industrial plant, but it may in the long run be counterproductive. It may be counterproductive simply because the residence time for injected particles, or gases which eventually nucleate to become particles, increases exponentially with the altitude at which they are injected. Thus, by going to higher stacks it is possible and even probable that the net nation-wide air pollution problem will increase, not decrease as originally intended.

I would recommend that the National Science Foundation solicit research projects to investigate gas and particle residence times and the attendant area wide air pollution build up on semi-global scales. From this research, it is quite probable that pollution control regulations may have to be modified. Again, however, I would caution that quite a substantial amount of research is needed before laws are modified regarding the stack height problem.

Arctic Air Pollution

In 1975 a small grant to the Geophysical Institute and to the University of Rhode Island resulted in the discovery of so-called Arctic Haze. It was found at that time that man-caused pollution products were being picked up in surprisingly high concentrations in the air near Barrow, Alaska. Since this discovery several institutions have been involved investigating the Arctic Haze and by now its properties are quite well known. I am attaching a copy of an article which appeared recently in Science, it provided an overview of the Arctic Haze problem.

Basically, Arctic Haze comes about because the removal mechanisms in the atmosphere (the mechanisms that cleanse the air by natural causes) do not operate effectively at high latitudes. One reason for poor particle removal is a lack of clouds and a low precipitation rate; another reason for slow cleansing action is that the atmosphere in the polar regions tends to stagnate in much the same way that a pool of cooled air will remain in chest freezers even in places like Phoenix, Arizona in summertime. Because of the low cloudiness and stable air masses, pollutants which flow into the Arctic Basin in rivers of northern-flowing air, tend to build up in concentration and linger in the atmosphere for considerable amounts of time. It has been estimated that the average residence time for gases and particles at places like the U. S. Gulf Coastal areas is one or two days; the corresponding figure for pollutants emitted into the stagnant air in interior Alaska is about twenty days residence time. This means, quite generally speaking, that air pollution in the interior regions of Alaska and in Arctic Alaska will be approximately ten times more serious (emissions being equal) than they would be at lower latitude locations. This fact has not yet been taken into account into the ways the present regulations are written.

I would recommend that special laws be formulated for Alaska in view of the very and fundamentally different air dispersion conditions that Alaska has in comparison to the rest of the nation. Though it may not be a pleasant fact to face, it nevertheless is true that air quality regulations are going to have to be made more stringent for the interior and Arctic regions of Alaska. It would be prodent to consider implimenting such legislation before air pollution problems in the se regions becomes worse than it already is.

Urban Alaska Air Pollution.

Fairbanks has extremely polluted air during the winter even though Fairbanks is a relatively modest city with practically no industrial emissions. The heavy air pollution is expected in view of what we know about the decreased cleansing action of the continental polar atmosphere.

I am attaching a listing of pollutants which have been measured at Fairbanks. Notice that the concentrations of essentially every compound listed is extremely high. There seem to be toxic metals present in the atmosphere at Fairbanks, which presently are unregulated, even though they may be causing serious health degeneration problems amoung Fairbanksans! Every "classical" pollutant so far measured at Fairbanks is breaking EPA recommended maximum exposure standards.

I have seen figures that indicate that lead and carbon monoxide levels at Fairbanks are improving in recent years. I have good reason to question such allegations, firstly because the improvements have occured since 1976 when the winters have been considerably warmer than normal (for unknown reasons) and secondly because the data used are suspect because sampling stations have been moved from place to place, starting at the old Postoffice building where the pollution is abnormally high and presently being on the second floor of the North Star Borough Building where the air may be cleaner.

The fact is that air pollution is a problem that Fairbanks will have to continue to take seriously. In the past three years wood burning fireplaces have caused extensive increases in air pollution at Fairbanks. If the trend continues, the day will surely come when a serious health problem will begin to show up. Last winter the air was so polluted in low-lying districts that many people complained of breathing problems. To weaken clean air regulations and to invite industry into the interior regions of Alaska is to take very real chances; this is particularily true because the chemistry is taking place in a nearly-saturated atmospheric environment.

Ammendments to the clean air act are desperately needed to control emissions at places with poor air dispersion. In this regard, no place in the nation has more serious air pollution potentiality than interior Alaska locations. I recommend that special regulations be formulated for Alaska to prevent the extensive ruination of the state by air pollution.

Pollution of the Arctic Atmosphere Confirmed

Although it is not as severe as in most cities, Arctic air pollution concerns scientists

When atmospheric chemists set up their air samplers in Barrow, Alaska, 600 kilometers into the vastness of the Arctic, they expected to be analyzing only telltale chemical traces of the sea and land. Instead, the filters that they used to collect atmospheric particles turned a grimy gray. In some ways, the particles bore a chemical resemblance to pollutants produced thousands of kilometers to the south. A few researchers became convinced that industrial pollution at times penetrates into the Arctic, a region that everyone had assumed remained pristine (*Science*, 20 July 1979, p. 290).

Now, researchers have sampled elsewhere in the Arctic and performed more kinds of analyses.* This new evidence has helped form a consensus that during winter and spring pollutants travel 5000 kilometers and more from industrial areas in Europe, Asia, and perhaps North America into the Arctic, producing a pervasive haze there. Although the amounts of pollutants in the Arctic are much smaller than those nearer industrial areas, they may still be sufficient to affect regional climate.

Part of the new evidence supporting Arctic air pollution comes from the air-sampling network established by Leonard Barrie and his colleagues at Canada's Atmospheric Environment Service, Downsview, Ontario. They collected aerosols, the microscopic particles suspended in the air that in sufficient numbers produce haze, at Mould Bay (1300 kilometers northeast of Barrow) and Igloolik (2500 kilometers east of Barrow). The aerosols at these locations turned their filters "flannel gray" and "sooty black" only during winter and spring, as happens at Barrow. At the Canadian sites, too, sulfate, vanadium, and other trace elements appeared in amounts too large to be accounted for solely by the sea salt or soil dust particles in the aerosol.

Because the only other likely source of vanadium is the burning of heavy fuel oil and coal, the Canadian group attributes the excess sulfate and vanadium to industrial sources in mid-latitudes. This same conclusion was reached earlier by Kenneth Rahn of the University of Rhode Island on the basis of sampling at Barrow. A third group, headed by James Peterson of the National Oceanic and Atmospheric Administration's (NOAA) Air Resources Laboratories in Boulder, Colorado, also studied the Barrow aerosol. They found that it increased when the wind blew from the north off the ice-covered Arctic Ocean, which suggested that the dirtied aerosol did not have a local origin.

A variety of chemical analyses now supports the polluted nature of much of the winter-spring Arctic aerosol. Joan Daisey of the New York University Medical Center examined the collected aerosols with a scanning electron microscope and found pollen in summer samples but fly ash and what appear to be black particles of carbon in spring samples. Hal Rosen of Lawrence Berkeley Laboratory, using Raman spectroscopy, identified "a major component of the aerosol" as graphitic carbon or soot. Charles Weschler of Bell Telephone Laboratories in Holmdel, New Jersey, identified organic compounds in the Arctic aerosol with a gas chromatograph–mass spectrometer system. He found numerous organic compounds typical of polluted air, including dimethyl silicones, synthetic compounds that are found, among other places, in photocopier chemicals.

Pollutants make up much but not all of the winter-spring Arctic aerosol.

According to Rahn's calculations, pollutants make up much but not all of the winter-spring Arctic aerosol. Of the total aerosol mass (not counting water), about 50 percent is pollutant sulfate, organic matter, soot, and other pollutants. If soil dust and sea salt particles, which are larger than 1 micrometer and contribute little to the haze, are excluded, pollutants compose about 80 percent of the haze during the winter and spring. Thus, even in the absence of pollution, there would still be some aerosol in the winter and spring, similar perhaps to the unpolluted summer aerosol, Rahn says.

The pollution of the Arctic atmosphere is not as heavy as that near most cities, but it is still considerable. The average concentrations of soot in New York City's air are ten times greater than the peak values of the Arctic haze. On the worst days in New York, there is 50 times more soot in the air than on the worst days in the Arctic. But peak Arctic values are as much as one-third of the average values in Berkeley, California. The winter-spring concentrations of sulfate, which can start out in the form of sulfuric acid, in the Arctic are one-fifth of those on the north shore of Lake Erie—midway between Detroit, Cleveland, Toronto, and Buffalo—and are about equal to the average winter values of the northeast United States. The Arctic concentrations are about ten times higher than "background levels" in other remote areas of the Northern Hemisphere, according to Rahn.

Researchers now agree that Arctic air can become dirty during winter and spring because of an unusual combination of meteorological and geographical circumstances. At that time there is little rain or snow to strip pollutants from the air as it moves northward into the Arctic. The Arctic in winter is something of a desert, Rahn notes. Some pollutants, such as sulfate and organic matter, can start out as gases, which will not fall out as particles do. Only later do the gases form particles. Also, the air masses injected into the Arctic by winter-spring circulation patterns can pick up pollutants from heavily industrialized areas in the northern reaches of eastern North America, Europe, and Siberia.

Researchers are still debating which one of these areas is the predominant source at any one time. The evidence at issue is the varying abundance of trace constituents of the aerosol. The amount of carbon and the amount of manganese in the Arctic aerosol, each measured relative to the amount of vanadium, vary through the year. Both of these ratios seem to be higher in coal-burning, metal-processing regions, where less heavy oil

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*A special issue of *Atmospheric Environment* (vol. 15, No. 9) devoted to the results of these measurements will appear in September 1981

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(a vanadium source) is burned. High early-winter aerosol ratios in the Arctic suggest that sources in the central Soviet Union predominate then, adding soot and metals to the air before it sweeps into the Arctic east of the Urals.

As winter progresses, the dominant source seems to shift to the west toward western Europe. Barrie believes that by spring this shift can extend to eastern North America, which could contribute by a route west of Greenland. Rahn favors a shift to a western European source but he thinks it seldom shifts farther. The route from western Europe is normally directly north over Scandinavia and the island of Spitsbergen. In either case, the longest routes into the Arctic are 5000 kilometers or more, requiring a travel time of at least 5 to 10 days. The most far-reaching pollutant transport pathway known until recently covered 2000 to 3000 kilometers.

Researchers still have only the vaguest ideas about how an enhanced, dirtied haze might affect the Arctic. The present center of attention is the black soot of the aerosol, a highly efficient absorber of solar radiation. Everyone agrees that it will heat the lower Arctic atmosphere in the spring—the question is how much. Rosen has made a "very preliminary" calculation suggesting that the rate of heating in the Arctic due to soot could be as much as that resulting from a doubling of the atmospheric carbon dioxide content. At a recent workshop in Boulder sponsored by NOAA, researchers interested in the effects of carbon in the atmosphere scrutinized those calculations and found them to be sound, within the severe limitations of the available data. In order to make more than a guess, they say, sampling must now be extended above ground level.

Although the discovery of pollution in the supposedly pristine Arctic atmosphere has startled scientists, pollutants probably do not travel in that fashion elsewhere. Rahn has been unable to identify other parts of the world where extremely long-range transport near the surface might occur. But pollutants that travel higher in the troposphere (see box) might similarly escape rapid removal, he says.

Efforts to further understand the origin and effects of the Arctic haze continue, with one handicap—disinterest on the part of the Soviet Union. Although it borders on fully one-half of the Arctic and apparently makes a sizable contribution to the problem, the Soviet Union continues to limit cooperative studies to the natural aerosols of its southern deserts.—RICHARD A. KERR

Table 1. Comparative Summary of Individual Pollutants Measured During Cold Times at Fairbanks.

Pollutant	EPA Primary Air Standards	Levels At Fairbanks	Levels At Industrialized Cities	Remarks
Carbon Monoxide	*9 ppm max 8 hr. conc. *40 ppm max 1 hr. conc.	ave conc. in Jan. for years 1974-1979; 7.6 ppm. Conc. decreasing in recent years. Peak levels much higher.	Typically 2-3 ppm	Exceeds EPA standards 30% of the time during cold weather.
Hydrocarbons	*0.24 ppm max 3 hr. conc.	3.50 ppm ave, winter 1973 9.7 ppm peak. Possibly x4 higher in recent years.	Typically 0.1 ppm	Exceeds maximum EPA standards by 1500%.
Oxides of Nitrogen	0.05 ppm annual mean	0.5 ppm ave. 1.8 ppm max 1 hr. peak	Typically 0.005 ppm	Exceeds maximum EPA standards by up to 1000%. Levels comparable to Brooklyn Tunnel.
Polycyclic Aramatic Hydrocarbons (PAH)	-	85 ng m^{-3} Dec. 1976	10-100 ng m^{-3}	Levels are as high as industrialized cities. PAH's are carcinogenic.
Lead	1.5 $\mu g\ m^{-3}$ 3 month ave.	15. $\mu g\ m^{-3}$ ave. for Dec-Jan, 1978	Buffalo, N.Y. 4.2 $\mu g\ m^{-3}$ San Francisco 0.7 Denver 3.0 Philadelphia 2.0	Lead is a factor of four times higher at Fairbanks than in industrialized cities. Lead poisoning?
Heavy Metals	-	Preliminary measurements by Zoller indicate that selenium, berylium, cadmium and zinc are high.	Comparatively low with respect to Fairbanks	Numerical data is sketchy. Preliminary measurements indicate concentrations are higher than in industrialized regions. Some are highly toxic.
Sulfur Oxides	*0.14 ppm max 24 hr. conc. 0.03 ppm annual mean	High concentrations observed when ice fog thickens.	Typically 0.005 ppm	Numerical data is sketchy. A possible problem during ice fog conditions. May exceed standards.
Photochemical Oxidants	*0.08 ppm max 1 hr. conc.	Detectable in summer, concentrations unmeasured.		A growing problem of photochemical smog in summer is occurring due to long daylight hours.
Ozone	-	31 nb partial pressure Nov-Dec.	10 nb partial pressure	Natural levels in the Arctic are high due to subsidence from stratosphere. No measurements at Fairbanks, but expected to be high.
Ice Fog	-	Occurs about 40 days per year.		Visibility problems cause psychological depression and auto accidents.
Suspended Particulates	75 $\mu g\ m^{-3}$ annual mean 260 $\mu g\ m^{-3}$ max 24 hr. conc.	Mass is low, but the number concentration of particles is 10^5 to 10^6 cm^{-3}.	Number concentration is typically 10^4	Respirable-sized particles, especially from wood burning stoves is a significant and growing health hazard.

* not to be exceeded more than once per year.

THE STANDARD OIL COMPANY

Statement
of
Kenneth E. Blower
and
Rik V. Shafer
on behalf of
The Standard Oil Company of Ohio (Sohio)
Before
Committee on Environment and Public Works
of the
United States Senate
concerning
The Clean Air Act

Fairbanks, Alaska
July 1, 1981

INTRODUCTION

Sohio's comments are focused upon the Prevention of Significant Deterioration (PSD) portion of the Clean Air Act (CAA) and are divided into three parts:

- Sohio's experience with the PSD provisions in the gaining of PSD permits for our Prudhoe Bay oil field
- Sohio's experience in PSD permitting of other major facilities and our concerns for the future permitting constraints for major energy projects
- Needed changes to the Clean Air Act to improve the PSD provisions

Before we discuss these issues in more detail, we would like to comment on the general theme of our statement. We believe that important progress has been made in addressing environmental concerns and we have learned a great deal - both technically and administratively - about the process for achieving clean air. While there continues strong support for achieving clean air, there is a growing awareness of competing issues, trade-offs, and alternative approaches that could lead to a more balanced attainment of environmental, economic, and energy related goals.

Our experience indicates that the maintenance of a sound environment and the development of domestic energy resources can be achieved -- they are not mutually exclusive goals. Some of the projects that we will be talking about today -- particularly Prudhoe Bay -- are good examples of this dual objective of energy development and sound environmental management.

Introduction (Cont'd)

At the same time, our experience indicates that there are needed changes to the Clean Air Act. Over the last ten years a great deal has been learned about air quality control. During the last five years we have worked with the concept of the Prevention of Significant Deterioration for clean air areas. We believe that a re-direction and re-balancing of these PSD provisions is essential. We are very much concerned with the complexity, uncertainty, and delay that characterizes the PSD permit program. Our statement highlights some of the problems we have experienced in working with this permit system. By and large, these are problems that result from an overly complex, detailed program -- a program lacking the analytical support tools and scientific foundation that enable clear, direct implementation.

It is important to note that the PSD provisions deal with "welfare" effects and not public health related concerns. Changes to the PSD provisions will not modify our national commitment to the protection of public health through the National Ambient Air Quality Standards (NAAQS). We believe that this is an important distinction that enables us to consider the re-direction of the PSD provisions to include our national goals of a sound economy and increased domestic energy production, as well as clean air concerns.

PSD PERMITTING - PRUDHOE BAY, ALASKA

The Prudhoe Bay area is a clean air (attainment) area and thus falls under the PSD permitting requirements. Sohio (and its operating partner ARCO) have obtained three PSD permits for our operations over the

PSD Permitting - Prudhoe Bay, Alaska (Cont'd)

last two years and have an additional application pending at present. These permits are required because the gas fired turbines and heaters needed to provide additional oil recovery from the Prudhoe Bay Field emit nitrogen oxides, which is a pollutant that is covered by the PSD provisions. Actually, two permits are required -- a state permit and a Federal PSD permit - for each major installation. Generally, it has taken us about nine months to obtain the PSD permit once the information is available to complete the application. To support our PSD application we have conducted one year of air quality and meteorological monitoring from April, 1979 to March, 1980. This monitoring program cost approximately $2 million. As expected, the ambient pollutant levels measured at Prudhoe Bay were consistently low, well below all existing state and federal air quality standards.

One of our main concerns is the level of detail and specificity that must be included in our PSD permit application. Because of our long-range planning needs and the lengthy time required to obtain a PSD permit, we must submit our PSD permit application 3-4 years prior to the date of actual operation of the unit in question. Included in the 3-4 year time frame are circumstances unique to our Alaska operations. Most of the major equipment and facilities for which PSD permits are required are fabricated in the lower 48, barged to Prudhoe Bay during the short 4-6 week open water season, and installed in place. Should permitting delays cause the open water "window" to be missed, significant project delays may develop. We find it extremely difficult to define the specific engine or heater size, stack height, and exhaust temperature at such an early stage in our design engineering. Yet the permit cannot be processed unless this information for air dispersion modelling purposes is available, and the permit must be modified if those parameters change during the normal course of our engineering study.

Aside from these difficulties, we remain concerned that the analytical tools available to predict the dispersion of pollutants are inadequate to support the quantitative nature of the PSD program. Tracking of the "PSD increments" for SO_2 and particulates has not been a problem at our Prudhoe Bay operations because clean burning natural gas is the primary fuel. Nitrogen oxides are the pollutants of most concern. However, for nitrogen oxides, the available modelling tools assume that all the nitrogen oxide emitted by the gas fired turbine or heater exhaust is immediately converted (oxidized) to nitrogen dioxide. In the colder Alaskan climate and the absence of daylight for many months, this is not a sound assumption.

The PSD provisions currently require the use of best available control technology (BACT) for all new and modified sources. We believe this requirement is a reasonable one -- if such a BACT determination is made promptly and reflects the regional and/or local circumstances associated with the facility, including economic factors.

Turning to the future, we would call to the Committee's attention the provisions of Section 166 of the Act. Should this section not be amended, it will require the continued expansion of the PSD program to more fully include the additional pollutants of hydrocarbons, carbon monoxide, ozone, and nitrogen oxides into a program that is as least as strict as the increment system. We believe that no additional PSD program for these so-called Set II pollutants is needed. Adequate air dispersion modelling tools are essentially unavailable for these pollutants. The use of BACT is already required to control emissions of these Set II pollutants and no further program development is warranted.

To summarize this portion of our testimony, Sohio's Alaskan experience indicates that significant changes are needed in the PSD program to enable continued development of Alaska's resources. Such changes focus on reducing the complexity, uncertainty, and delay associated with the PSD permitting process. We urge this Committee's consideration of the following issues in amending the CAA:

- Early definition of specific equipment and parameters for PSD permit application
- Lengthy time required for permit processing
- Analytical modelling tools insufficient
- Definition of BACT is a delaying factor
- Potential for PSD Set II constraint

PSD PERMITTING - LOWER 48

Sohio has conducted ambient air quality monitoring at five additional locations in the Lower 48 (3 refineries, 1 chemical complex, and at our oil shale tract). Our experience indicates that the cost associated with gathering one year of ambient data at existing industrial sites is about $250,000. We have also found that it takes about 1-1/2 - 2 years to

PSD Permitting - Lower 48 (Cont'd)

conduct the entire program and collect one year of ambient data. Additional time is required to gain EPA approval of the monitoring locations, obtain land for the monitoring equipment, and complete the contractural arrangements for the operation of the analytical program.

At our Marcus Hook refinery in Pennsylvania, we just finished a one-year monitoring program that actually had an elapsed time of 29 months between project initiation and issuance of the final report. Over 18 months has been devoted to finalizing an emissions baseline for this refinery so that a net emissions change due to a planned modification could be calculated. Similar programs have been conducted at other Sohio refineries even though state and local air monitoring stations were located within 3-4 kilometers of the refinery. Despite this proximity State and Federal agencies determined that these sites were not in the precise location necessary to assess the air quality impacts of the facility in question.

A second issue in the Lower 48 is the PSD constraints on the development of shale oil facilities in Colorado and Utah. In these areas, the Class I and Class II increments for particulates and sulfur oxides, along with visibility requirements are of concern. Air dispersion modelling techniques are not available for the rough terrain oil shale areas. At this time we have no reliable method of predicting the amount of increment (SO_2 or particulate) that is consumed by a specific project nor is there any way to "track" and accumulate increment consumption from different facilities. Class I increments are a small fraction of the ambient air quality standards and monitoring and modelling techniques are

are not sensitive enough to accurately deal with such small levels. Of critical import is the geographical spacing of plants in this area to avoid "using up" all the increment. Yet, the presence of energy resources places site specific requirement on facilities to extract and economically develop the resource.

The Act currently requires the prevention of any future impairment of visibility in Class I areas. The analytical tools available to assess and predict visibility impairment are even less developed than those available for more traditional air dispersion modelling. In the shale oil areas these Class I increments and visibility requirements have the potential to constrain and delay needed energy development.

A number of other Sohio projects have been affected by CAA restrictions. In virtually all cases the level of control on emission sources has not resulted in increased pollution control beyond BACT. Rather, there has been substantial delay, numerous letter exchanges and telephone conversations, and substantial uncertainty throughout the permitting process. Briefly described, the problems are:

- PSD permit application for an entire chemical complex denied, case-by-case permitting of each major unit required.
- A one-year delay in the PSD permitting of a sulfur recovery unit at a refinery, installation of the unit would reduce emissions.
- Continual change in EPA personnel handling permits, lack of continuity in permit processing.

PSD Permitting - Lower 48 (Cont'd)

Additional more detailed information on the cases discussed in this section are included in the Appendix.

Principal CAA Issues:

- Extensive monitoring programs to support PSD permit applications, leading to delay and high cost
- Constraint and uncertainty that accompanies PSD increment and visibility requirements
- Permitting delay that is essentially unrelated to pollution control requirements
- Continual change in EPA permitting personnel and mutual uncertainty in dealing with the complex PSD provisions

NEEDED CHANGES TO THE CLEAN AIR ACT

Sohio has participated with the American Petroleum Institute (API) in developing needed CAA amendments. API has addressed a number of CAA issues but the PSD provisions are generally viewed by our industry as a key amendment item. Through this joint activity the following changes to the CAA have been identified:

- The CAA should be restructured to require the utilization of BACT on new and modified sources. Combined with this BACT review would be a preconstruction review to insure that NAAQS would not be violated by the addition of the new source. The increment provisions should be eliminated and permitting review procedures speeded up.

Needed Changes to the Clean Air Act (Cont'd)

This change would vastly simplify the permitting requirements for Class II and Class III areas while retaining the protection of the NAAQS.

- In areas having national unique scenic values, an additional air quality review should be conducted to preserve these scenic values. These unique scenic areas have varying characteristics and protection requirements. The result of this special air quality review may lead to a localized ambient air quality standard, special visibility requirements, or some type of limited access waiver that would protect the value for which the area was designated, but at the same time balance the utilization of the unique scenic areas with other national goals.

  Sohio remains concerned that the technical and procedural problems associated with the Class II and III increment system are magnified in the Class I increment system. While elimination of short term Class I increments is important, we also believe that the annual increment system is technically and procedurally flawed. We agree that some special areas of the country require special protection, but we urge that the utilization of an increment approach be reconsidered.

- Requirements to reduce any visibility impairment from existing sources and prevent any visibility impairment from new sources

Needed Changes to the Clean Air Act (Cont'd)

should be modified. First, the CAA should be modified to focus on significant visibility impairment rather than any visibility impairment. Second, a great deal more scientific study is required to provide a sound technical foundation for visibility regulation. The Act should be amended to encourage the scientific study of visibility impairment and delay premature visibility regulatory requirements.

- Permitting requirements should be simplified to reduce the delays and uncertainty associated with PSD permitting. Agency sponsored monitoring stations should be the major source of ambient air data for permit application review. BACT determinations can be simplified by utilizing NSPS requirements where they exist. Fugitive dust, mobile source emissions, and secondary source emissions should be excluded from general review procedures.

- The CAA should be amended to eliminate the requirement to extend the PSD program to the Set II pollutants. The BACT review, coupled with continual reduction of mobile source emissions, provides sufficient protection.

SUMMARY

Sohio welcomes the opportunity to discuss our experiences with the PSD portion of the CAA with the Committee. Our major concern rests

Summary (Cont'd)

with the complexity, delay, and uncertainty associated with the PSD permitting procedures. We find that many of our field people have "gotten used to" delays of 1-2 years in permit-seeking and treat it as normal procedure. That does not need to be the case. Significant and important changes can be made while still providing air quality preconstruction review, air quality management, and public health protection through the National Ambient Air Quality Standards.

Sohio has been active in the development of the American Petroleum Institute (API) information on the CAA. A copy of API's issues booklet is included in the Appendix. In addition, amendatory language implementing many of the needed changes to the CAA have been developed and is available to the Committee.

Authors

Kenneth E. Blower is in Sohio's Corporate Environmental Affairs Department in Cleveland, Ohio. He provides legislative and regulatory advice on air quality matters to all areas of Sohio. He is serving as Chairman of API's task force that has developed the API CAA issues booklet, "A Needed Balance," and the accompanying amendatory language package.

Rik V. Shafer is Manager of Sohio's Environmental Affairs Department for Sohio Alaska Petroleum Company. He is responsible for environmental issues related to the Prudhoe Bay development.

APPENDIX

I. CAA Case Studies

- PSD Monitoring Requirements
- PSD Baseline Determinations
- PSD Permitting of a Major Chemical Complex
- PSD Permit for a Sulfur Recovery Unit

II. API CAA Issue Booklet, "A Needed Balance"

PSD MONITORING REQUIREMENTS

DESCRIPTION OF THE CASE

Sohio initiated an ambient air quality monitoring study in the vicinity of its three refineries located in Lima and Toledo, Ohio, and Marcus Hook, Pennsylvania to collect data for a PSD permit. This study was to be done as a matter of general policy, even before specific commitments for any expansion or modification which would require a PSD permit were made. It was felt that this would eliminate the 15-18 month delay associated with collecting the data at a later date when timing on a specific project requiring a permit could be critical.

Management requested that preliminary work be conducted to determine the cost of such a program in January, 1979. Initial contacts to state and federal agencies were made in February, 1979, and a request for proposals was sent to 5 contractors. The proposals were received in mid March, 1979. On May 21, 1979 the contract was awareded to Engineering-Science, and preparation of the workplans to be submitted to the agencies of authority began. Short and long term modelling of SO_2 and particulates was conducted for each site. Workplans were submitted during the period from August 9-September 7, 1979. On September 11, 1979 the workplan for Marcus Hook was approved, and site selection and acquisition began. Two sites were selected, but local politics eliminated both of these sites. An alternate site for one of the two sites was found immediately, but an acceptable second site was not located until the end of December, 1979.

Approval of the Lima and Toledo workplans was denied in October of 1979, pending resolution of ten items. Meetings were held with Region V officials in November, at which time it was decided that half of the items need not be addressed after all. The other items were addressed in an addendum to the workplans, submitted in early December. Final agency approval came in early January, 1980.

Two sites were located near each refinery, and all were instrumented and monitored by the end of February, 1980.

Problems were encountered while monitoring and data caputre rates were not as high as required in the monitoring guidelines, so the program had to be extended at several sites. The final report should be issued in June of 1981

PROBLEMS ILLUSTRATED BY THE CASE

This case illustrates two problems very clearly. First is the time delay associated with the monitoring requirement. A total of 29 months elapsed between the decision to monitor and the expected issuance of the final monitoring report. Second is the cost of monitoring. Approximately $750,000 was spent to monitor 6 sites (2 sites at each of three locations). Both of these problems have th potential to significantly increase the cot of a project to the point it is no longer economical. Over this time period, the CE plant cost index rose 54% and the construction cost index rose 516.40%.

In every one of the three locations, state and local monitoring stations were located within 3-4 kilometers of the plant. State and federal authorities determined that these sites were not located to sufficiently assess the air quality impact of the facilities in question.

CHRONOLOGY OF THE CASE

A total of 29 months elapsed between the initial decision to monitor and the expected issuance of the final monitoring report. This time would all have to be spent prior to the submittal of a PSD application. After the monitoring data has been collected and the application prepared (an additional estimated 2-3 months), the permit application could be filed. Total time from decision to monitor until formal application is 31-32 months. Agency review, public hearings and permit issuance would all add to the time delay if a specific project was being considered.

COST IMPLICATIONS

a. Administrative/Technical costs to conduct monitoring program.

Sohio Staff Time	$ 35,022
Computer Modelling	2,710
Travel	1,490
Monitoring Contractor	711,045
Total	$ 750,267

This total is for monitoring at 2 sites at each of 3 locations.

SUGGESTIONS FOR IMPROVEMENT

Eliminate the monitoring requirement where agency monitors are located in close proximity to modified or new facilities. Monitoring should only be necessary in extremely remote areas, and in very few cases.

PSD BASELINE DETERMINATIONS

1. DESCRIPTION OF THE CASE

In January 1980, Sohio began consideration of potential modifications to our Marcus Hook refinery and the necessary environmental permits. Some changes in pollutant emissions would likely occur due to these modifications but the actual magnitude of the change (and thus the regulatory requirements) would not be determined until a pollutant baseline was established. Once the baseline is determined, one could calculate whether a net increase or decrease in specific pollutant levels would occur.

2. PROBLEMS ILLUSTRATED BY THE CASE

Procedures for determining a baseline for a complex facility such as a refinery are essentially not available. The difficulty in having a procedural base results in considerable delay and uncertainty in regulatory requirements.

Since one approach in determining baseline levels is the use of actual historical emissions, there is a motivation to operate sources at the full allowable emission level, thus having a high baseline to work within.

3. CHRONOLOGY OF THE CASE

February, 1980	Met with local state agency to discuss method for setting baseline
March, 1980	Met with state and local agency personnel to develop guidelines for setting baseline
July 11, 1980	Company submitted baseline proposal based upon established procedure
July 17, 1980	Minor revision submitted to agency
July 25, 1980	In response to request, submitted detailed emission calculations
September, 1980	Met with agency to reach agreement on baseline, conditioned on submittal of additional data which was submitted 11 days later
November, 1980	Agency indicated baseline not acceptable
January, 1981	Letter to agency reviewing history and questioning reason for problem
February, 1981	Agency indicates official denial of baseline proposal and identifies deficiencies

April, 1981	Revised baseline sent to agency
May, 1981	No action on revised proposal

4. SUGGESTIONS FOR IMPROVEMENT

- Emission should be calculated on a consistent basis--allowable emission levels would be preferred calculated on an annual basis.
- Federal case-by-case review of specific state actions should be eliminated.
- PSD should apply mainly to unique scenic areas (Class I). For other attainment areas BACT and a review against NAAQS should suffice.

PSD PERMITTING OF MAJOR CHEMICAL COMPLEX

DESCRIPTION OF THE CASE

Early in 1976 Vistron Corporation (a wholly owned subsidiary of The Standard Oil Company-Ohio) finalized plans to construct a petrochemical complex in the Gulf Coast area. The complex was ultimately to include eleven process units to be constructed over a period of time commencing in July of 1979 and completing in January of 1986. Site selection studies, both economic and environmental, were completed and after consultation with federal and state agencies as well as with environmental groups, a plant site was selected in Calhoun County, Texas. Calhoun County is primarily an agricultural area with (at the time) only two industrial faciltiies of any consequence. It was classified as "attainment" for all criteria pollutants.

After consultation, in October of 1976, with appropriate state and federal agencies, it was determined that the full range of permits typical of a grass roots facility would be required as well as an Environmental Impact Statement. It is important to note at this point, that it was agreed to at the outset, that wherever possible, the permits would be issued for the total complex since construction of the facilities would be virtually continuous from 1979 until 1987. Environmental studies and preliminary engineering were started early in 1977, and in October of 1977 an ambient air quality monitoring program was started.

After passage of the Clean Air Act Amendments in August of 1977, it was determined that the Vistron Project would also be subject to review under Prevention of Significant Deterioration provisions of the law. Accordingly, a PSD permit application was prepared and submitted to the Region VI office of USEPA on March 30, 1978. With full concurrence by USEPA, the permit application was prepared for the total complex, considering emissions from all eleven process units and ancillary facilities planned for the project.

Dispersion modeling studies demonstrated that the National Ambient Air Quality Standards would not be exceeded and that the PSD increments for particulates and sulfur oxides would not be exceeded. The other impact analyses and the BACT demonstration were accepted by USEPA.

Review of the PSD application proceeded very slowly. Although the application was declared "complete" in June of 1978, it did not go to public notice until the end of February 1979, for a hearing to be held on March 26, 1979. Throughout the review period and in the public notice EPA declared its intention to issue the permit as requested, that is, for the total complex.

During the public hearing, the majority of the testimony was positive. Peak construction manpower of about 3,300 would be required and a permanent workforce of 1,600 would significantly increase jobs in the area. The new complex would have a major positive effect on the area economy.

However, two industrial neighbors objected to issuance of the permit for the whole complex on the grounds that award of the PSD increment for a long term project might restrict other development in the area. At the conclusion of the hearing EPA directed Vistron to respond to the objections within two days. Vistron prepared a comprehensive report demonstrating that the objectors' fears were unfounded. The impact of Vistrons' SO_2 emissions consumed only

15% of the annual PSD increment, 12% of the 24 hour and 8% of the 3 hour increment at the neighbors' plant sites.

In spite of this demonstration, USEPA Region VI on March 30, 1979 granted Vistron a PSD permit which allowed only the first planned unit. Continuing appeals to the regional administrator failed to change EPA's position. Vistron thus faces the requirement of obtaining PSD approval for each succeeding unit planned for the complex.

Environmental permitting activities have begun for a second major process unit for the Texas complex. Early discussions with USEPA indicate considerable uncertainty as to how to proceed.

- Will the PSD review be conducted under the regulations of June 1978 or August 1980?
- Will additional monitoring be required?

To further complicate matters, EPA has recently granted PSD authority to the state of Texas. Thus there is the possibility that future PSD review will be done by an agency different from the one with whom we started.

TABLE A

PROBLEMS ILLUSTRATED BY THE CASE

- Unnecessary delays - USEPA and/or their review contractor took the full 12 months to review and issue the PSD permit.
- Changing regulations or interpretations - After declaring up to the last minute EPA's intention to issue a PSD permit for the total complex as a phased project, EPA changed its mind and issued the permit only for the first process unit thus leaving the future shrouded in uncertainty.
- Redundant reviews - PSD review with USEPA - Revion VI; Permit to Construct New Source Review With State
- Inaction on part of review agency
  Yes USEPA Region VI
- New data required because of public hearing -Yes
- Difficulties with determination of PSD increment and increment consumption
- Other - During the air quality monitoring program the ozone standard was exceeded on two days. EPA advised the state, but the state has not processed an SIP revision to redesignate Calhoun County from attainment to non-attainment. The USEPA is treating Calhoun County as non-attainment, thus requiring offsets. We foresee and are encountering difficulties in permitting of future units in the complex.

SUGGESTIONS FOR IMPROVEMENT

The PSD process should be simplified and standardized so that the review can be expedited. This would also minimize the impact of another problem Vistron encountered, that of frequent personnel changes at EPA.

PSD PERMIT FOR SULFUR RECOVERY UNIT

1. DESCRIPTION OF THE CASE

In November 1977, The Standard Oil Company decided to install a sulfur recovery unit (SRU) at its Toledo Refinery to comply with the Federally promulgated SO_2 SIP for Ohio. On November 30, 1977 a plan for control was forwarded to the USEPA, Region V. The plan called for the installation of a Claus sulfur recovery unit with construction to begin by May 1, 1978 and operation by June 1, 1979. A similar report was forwarded to the stage agency at the same time.

In December 1977 the Ohio EPA was contacted regarding the need for any permits. The agency concluded that permits were not necessary because the SRU was being installed to comply with the the SO_2 SIP and that it was a control device which reduced SO_2 emission rates. The agency suggested that we file final control plans with them. This was done on January 12, 1978. On January 24, 1978 the agency officially verified their December 22, 1977 response regarding permits. In addition, the agency suggested that we contact Region V regarding the applicability of PSD regulations, since sulfur recovery plants were listed in the regulations as major sources .

Region V was contacted and a meeting held on February 24, 1978. At the meeting, Region V concluded that a complete PSD review was necessary. They also requested a formal letter for clarification of some items. Specifically the area was designated nonattainment for SO_2 with the scheduled attainment date being June 17, 1980 (one year after our scheduled operation date). EPA projected a 4-6 month review period. Including the time for permit application, a 6 to 8 month delay in start of construction would result. Even though the SRU would reduce emissions this could not be shown in the application since Region V did not have the acid gas (H_2S rich) flare emissions in the "baseline".

On March 7, an official request was made to Region V regarding PSD permitting and identified our commitment to the State to install final control by June 1, 1979. The letter indicated that PSD approval was needed by May 1978 to achieve a June 1, 1979 compliance date.

On March 15, 1978 a meeting was held with Region V to review PSD permitting progress and to discuss key issues associated with the application. An area not resolved at the meeting dealt with background SO_2 concentrations. On March 16 and 17, 1978, Region V contacted us concerning this area. 15 ug/m^3 was set for the background with an option to use a lower number if need be.

On March 29, 1978 we contacted Region V regarding our March 7 letter. Region V indicated that a reply was forthcoming. They did say that construction could not begin until PSD approval was granted. Region V felt this justifiable since completion would occur sometime in 1980.

On April 10, 1978 a formal response to our March 7, 1978 letter was received. Basically Region V made the following conclusions:

1. The SRU is subject to PSD.
2. Since the area is nonattainment for SO_2, the Emission Offset Policy applies if start-up occurs in 1979.
3. These reviews should not jeopardize the ability to achieve compliance by June 1980 (the final date for compliance in the Federally promulgated Ohio SO_2 plan).

To avoid the provisions of the offset policy, a decision was made to delay start-up until June 1980, one year later than previously planned. Thus, a PSD permit would only be required. During this one year period, SO_2 emissions were substantially higher than if our original schedule had been met.

On June 7, 1978 the PSD permit application was filed. On July 25, 1978 a revised construction schedule was forwarded to Region V. On August 2, 1978 additional information was forwarded to Region V at their request. It included the following:

- Process flow diagram
- Incinerator data
- The procedure used to select stack height.

On August 25, 1978, Region V contacted us regarding some problem areas. These included stack height and stack temperature (1500°F vs. 1100°F). Region V felt that 30 meters was GEP for the incinerator stack and should be used in the modeling rather than 67 meters (actual stack height).

On September 22, 1978 we forwarded a letter to Region V regarding the stack height and temperature. Although we disagreed with the changes, in the interest of time, we decided to use the lower numbers. Additional modelling had been done which showed no significant changes in ground level concentration. The letter emphasized the need for a quick review on the part of Region V and the fact that SO_2 would be reduced by 55 to 190 tons/day.

On October 16, 1978 Region V was contacted regarding the status of the permit. Region V indicated that unofficial preliminary approval had been granted. Official preliminary approval would follow in 3 to 4 weeks. This would not permit construction to begin.

On October 24, 1978 we contacted Region V to arrange a meeting with the Chief of Air Enforcement in an effort to expedite the PSD review. Region V presented a revised schedule showing final approval by December 15, 1978. Region V also indicated that the Chief would not meet with anyone regarding PSD.

On November 9, 1978 additional data were sent to Region V at their request. The data included SO_2 reduction estimates and a discussion regarding the size of the unit.

On November 14, 1978 the USEPA officially indicated that the application was complete and gave preliminary approval. The public notice appeared in the Toledo Blade on November 17, 1978. Official final approval was granted on March 1, 1979. The SRU was operational in June 1980.

2. PROBLEMS ILLUSTRATED BY THE CASE

There were several problems associated with this case. Foremost was the need for a PSD permit, and potentially offsets, for a system that significantly reduced SO_2 emissions. The PSD program for the SRU caused a one year delay in the refinery achieving compliance with SO_2 regulations.

Another problem deals with the constant change in EPA personnel working on the permit. As soon as one EPA representative became familiar with the project he was replaced by someone else. There also appeared to be a lack of continuity. Requests were made for detailed computer print-outs of modelling runs. Later, when they were received by EPA, we were questioned as to why they were sent.

The final problem deals with the difficulty in getting EPA to make decisions. When asked questions on certain subjects the answers were usually labeled as unofficial, with official replies many week later.

Overall the delays caused by EPA requiring a PSD Permit resulted in approximately 480,000 tons of SO_2 emissions that would have been controlled.

3. CHRONOLOGY OF THE CASE

The case is fully described in the first section. The table below lists the major items of importance for the case.

DATE	ITEM
11/77	Decision made to install sulfur recovery unit.
11/30/77	General compliance plan sent to EPA and Ohio EPA. Called fur SRU to be operational by June 1979.
12/22/77	Ohio EPA concluded that no permits were necessary. Required submittal of final control plans only.
1/12/78	Final control plans forwarded to Ohio EPA.
1/24/78	Ohio EPA written verification regarding 12/77 opinion on permits. Suggested we check with Region V regarding PSD.
2/24/78	Meeting with Region V. Concluded PSD review necessary. No credit for emissions reduction. Projected 4-6 month schedule for review and issuance of permit.
3/7/78	Official request for PSD permit determination, highlighted committment to State to operate by 6/1/79.
3/15/78	Meeting with Region V on PSD permitting.
3/29/78	Contacted Region V regarding request letter of 3/7/78.
4/10/78	Formal response from Region V recieved. Both PSD and Offset Policy apply if operation occurs before June 17, 1980 (scheduled attainment date).
6/7/78	PSD permit application submitted.
7/25/78	Additional data submitted at Region V request.
8/25/78	Telephone contact. Region V wanted change in stack height for modelling and lower stack temperature used (represents possible heat recovery).

9/22/78	Written response to EPA concerns. Additional modelling done using shorter stack and lower temperature. Data provided.
10/16/78	Contacted Region V regarding status, stated preliminary approval should be granted in 3-4 weeks.
11/9/78	Additional data forwarded to Region V. Covered SO_2 reduction estimates.
11/14/78	Completeness certification and preliminary approval received.
11/17/78	Public notice in Toledo Blade.
3/1/79	Permit issued.
6/80	SRU operational

4. Cost Implications

Cost implications are not readily available. We do have approximate costs for obtaining permits. Our figures show a cost of $14,000 for environmental engineering to prepare and obtain permits. Computer costs for modelling are not available.

5. Suggestions for Improvement.

A. Eliminate need for PSD review of control equipment installation (This may be corrected by the latest regulations which speak in terms of net increase).

B. Provide continuity within EPA departments and Regions. There should not be a Region by Region interpretation of regulations.

C. Upper level EPA officials should be available to handle petitions on decisions made by EPA staff.

D. Improve the response time of EPA in dealing with requests.

Amending the Clean Air Act—

A Needed Balance

American
Petroleum
Institute

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In the 1970s, our nation made needed environmental progress, but also suffered a decline in our energy security. So, today we recognize the need to balance several important national goals: protecting our environment; producing more energy; and maintaining a sound economy. To achieve all of these goals, we must carefully adjust environmental laws—such as the Clean Air Act—that do not reflect a proper balance.

We passed the Clean Air Act as our nation was awakening to its environmental problems. We knew little about air pollution causes and controls, but we felt a clear need to begin solving the problem. And, indeed, we made much progress during the past decade.

However, during the same decade, our dependence on unstable sources of foreign oil doubled. Thus, as we begin a new decade, the nation faces a dangerous predicament—but one that can be resolved.

Amending the Clean Air Act—A Needed Balance

The U.S. has vast energy resources—enough to regain our energy security in the decade of the 1980s. Regaining that security will require both continued energy conservation and government policy changes to permit: more energy production from federal lands; orderly nuclear growth; more reliance on the market system; synthetic fuel development; and better balance between continued environmental progress and U.S. energy development.

In particular, we need to make the Clean Air Act simpler and more flexible and its regulations scientifically and economically sound. Energy resources, when developed, must be developed where nature put them. With balanced policies, we can develop those resources in an environmentally safe way.

We know much more about air pollution causes and effects than we did when the Clean Air Act was passed. With some careful changes in the law, the public will benefit as the nation moves toward both its environmental *and* energy goals — including reduced oil imports. While these goals may often compete, they are not mutually exclusive.

Improvements are needed in the way our clean air standards are set and the way we seek to meet those standards.

Setting the Standards

National Ambient Air Quality Standards, which set the pollution limits for the air around us, should be reviewed and revised both to reflect sound, up-to-date scientific evidence and to provide a balance with other important national goals.

This point is crucial because the standards are, in a sense, the driving force for most efforts at air quality control. So, they should be no stricter than necessary and should be attainable.

However, in setting some standards years ago, the Environmental Protection Agency (EPA) did not take into account the quality of the scientific and medical studies used as a basis for the standards. Also, EPA has not adequately considered newer studies that question earlier assumptions. And the whole process of setting standards and deadlines generally ignores trade-offs in important areas such as energy and economic development. In fact, the Act—as EPA interprets it—does not allow consideration of whether the standards are even attainable.

Meeting the Standards

Overall, the complex government processes for approving energy and other projects need to be simplified and merged into a single review by the states.

The existing review process for obtaining government permits wastes a substantial amount of time, manpower and other resources. The government has two separate types of review that can apply to seven different air pollutants. One review applies to pollutants in "nonattainment areas," or places that do not meet the ambient air quality standards for these pollutants. The other review applies to pollutants in "attainment areas," or places that do meet the standards for those pollutants.

Both reviews are extremely complex, cumbersome and time-consuming. In many cases, a single project or even a single pollutant may have to undergo both types of review. And each review may be conducted separately by both federal and state authorities.

The delays in approval usually do not change the project's potential emissions significantly. That is, a quicker decision — whether "yes" or "no" — usually would provide air just as clean. Yet, the review requirements are increasing, and the delays in government decisions thus may also increase.

In nonattainment areas, rigid deadlines, sanctions and requirements for "emissions offsets" need to be more flexible.

Before a project in a nonattainment area can proceed, a company must meet several cumbersome conditions, including an "emissions offset." That is, the company must find a way to more than compensate for its project by reducing other emissions in the area. For example, a company may pay for better pollution controls on someone else's plant or buy an older plant and shut it down. However, in many nonattainment areas with high energy potential, few offsets are available—maybe even none at all. Where available, they will eventually be used up.

Also, arbitrary national deadlines for meeting the standards can unnecessarily prevent energy development and damage the economy. Where the rigid deadlines for attainment cannot be met, no permit can be issued under any circumstance. This construction ban is an ineffective, punitive measure that can actually *delay* environmental progress by delaying the replacement of old, polluting facilities with modern, clean ones.

In attainment areas, rules should be changed to protect unique scenic values where they exist, but otherwise to allow energy development that meets normal review requirements for the ambient air standards.

For all attainment areas, the government imposes limits far stricter than the national ambient air standards that protect public health ("primary standards") and public welfare ("secondary standards"). These stricter limits are special "Prevention of Significant Deterioration" (PSD) requirements and, more recently, separate visibility requirements. Special protection is certainly appropriate for areas such as national parks. However, the stricter requirements extend to other attainment areas that have no unique scenic value, but do have enormous energy and economic potential. In these areas, the requirements can block or delay energy projects—no matter how clean they are—with virtually no compensating benefits in air quality.

Newer Initiatives

Two additional subjects — "hazardous air pollutants" and "acid precipitation" —will probably receive more attention in the future. Experience with other portions of the Act can help determine the wisest course of action here.

Hazardous air pollutants—those that may be toxic or cancer-causing—must be regulated if they pose a significant risk of serious harm. So far, only seven substances have been formally listed as hazardous pollutants, and only four have been regulated. However, EPA has been pressured to expand this program to include dozens of substances for which there is little or no sound evidence that they are hazardous air pollutants. If the effort to control hazardous air pollutants is to be workable and successful, regulations should be restricted to pollutants posing a significant public health hazard. The regulations should be based on sound scientific evidence and the most cost-effective control strategies.

Potential regulation of air pollutants in general can be considered in several ways, and the best way should be chosen. Some pollutants should be controlled under special measures for hazardous air pollutants. Others may be controlled under ambient standards for more common pollutants. Still others may pose an insignificant risk and need only to be monitored, not controlled.

Concern over allegations of higher-than-normal or increasing levels of acidity in rain or snow (acid precipitation) has led to proposals for additional controls under the Clean Air Act. However, scientific evidence does not show conclusively that acidity of precipitation is increasing. EPA's Clean Air Scientific Advisory Committee concluded in November 1980 that there is insufficient scientific basis to set or modify air quality standards because of acid precipitation. The causes and effects of acid precipitation do deserve further research, and Congress has already funded a 10-year study. But until more is known, additional legislation or regulation would not be prudent.

Specific Recommendations for Clean Air Act Improvements

National Ambient Air Quality Standards

1. A qualified scientific body should evaluate the air quality standards and the scientific basis for the studies that support them.

2. Secondary standards — which are not health-related, but which protect other values such as property and aesthetics — should be based on the marginal costs and benefits and take into account regional differences.

Nonattainment Areas

1. States that make good-faith efforts but cannot meet the deadlines for attaining the standards should be able to set later deadlines if progress continues.

2. Government review of proposed energy projects should balance the need for emissions offsets with the need to reduce oil imports and maintain a sound economy.

3. The construction ban should be eliminated because it is ineffective in improving air quality.

Attainment Areas

"Prevention of Significant Deterioration"

1. The current system for protecting clean air should be replaced with requirements for use of the "Best Available Control Technology" (BACT), and a review to ensure that the national ambient air standards will not be violated.

2. In special areas such as national parks or forests, there should be additional review to protect the special environmental values.

3. No visibility requirements should be imposed until an adequate way to measure visibility impairment is developed.

Government Permitting

1. The separate review processes for protecting clean air and cleaning up dirty air should be merged into one review by the states with appropriate time limits for the review. To avoid unnecessary delays and allow for varying state-to-state conditions, federal authorities should not review individual state actions after the state's overall air quality plan has been federally approved.

2. The entire permit process should be further simplified by:

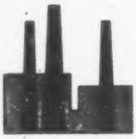
- *making the two separate definitions of emission controls — "Best Available Control Technology" and "New Source Performance Standards" — the same;*
- *allowing full use of the "bubble concept" (that is, a single emissions limit for an entire plant or even several nearby emissions sources, rather than separate rules for separate pieces of equipment);*
- *calculating emissions on a consistent basis;*
- *excluding fugitive dust, mobile source emissions and secondary source emissions (from trucks or other sources associated with a major project) from the review process for major projects; and*
- *reducing delays caused by air quality monitoring and computer air quality modeling requirements.*

3. To allow sound economic planning: new standards for control technology should not be retroactive; stricter permit requirements should not be imposed after an application has been filed, and projects should be protected from "retrofit" requirements until 10 years after start-up.

Economic Criteria

1. EPA should assess the energy and economic impact of all major proposed standards and regulations. Peer review of these studies should be strengthened.

2. Every five years, the cost-effectiveness of existing standards and regulations should be reviewed.



Hazardous Air Pollutants

1. "Hazardous air pollutants" should be redefined to assure that only pollutants posing a substantial increase in the risk of serious harm are regulated.

2. The listing procedure for hazardous air pollutants should include: a quantitative risk assessment based on the best available evidence; an assessment of regulatory options; chance for review and comment on the proposed listing and the supporting material; and chance for quick judicial review of final listing decisions.

3. EPA should assess the health, economic, energy and environmental effects of each option for controlling hazardous air pollutants.

Acid Precipitation

1. The federal research program on acid precipitation should cover: trends in precipitation acidity; sources, transport and effects of acid precipitation; and various control strategies that include land and water management. This research program should be periodically reviewed and revised.

2. Any standards and regulations that may be required to control acid precipitation should be cost-effective and based on sound scientific studies.

National Ambient Air Quality Standards

General Policy

The Act should provide a means of establishing National Ambient Air Quality Standards (NAAQS) that are based on sound medical and scientific evidence and that will protect, with an adequate margin of safety, the public health and welfare. Those standards, as well as the plan developed to achieve them, should take into account these important national goals: producing more energy and maintaining a sound economy.

Current Situation

The Act directs EPA to set NAAQS that protect the public health and welfare. However, the Act, as EPA interprets it, does not allow that agency to consider if those standards can be attained or the costs and benefits of attempting to do so. Moreover, the Act provides virtually no guidance on how stringent the standards should be, how to evaluate health data or how to decide on an "adequate margin of safety."

Furthermore, EPA does not adequately assess the quality or significance of the studies it uses as a basis for setting the standards. Also, EPA's prescribed methods for demonstrating that the states meet the standards do not allow the states to adequately consider variations in meteorological conditions, measurement methods or natural emissions.

Recommendations

EPA should:

1. Set "primary standards" at levels which protect the public health with a margin of safety; however, when setting that margin of safety, EPA should consider other relevant factors, such as attainability and additional costs and benefits.

2. Define adverse health effects and establish a methodology for evaluating health risks. EPA's criteria documents and policy analysis documents should evaluate the studies that are used as a basis for deciding a pollutant's health effects. Moreover, EPA should recognize the importance of using studies whose findings are supported in other studies. A qualified scientific body, the Science Advisory Board or the Clean Air Scientific Advisory Committee, should then evaluate the studies used in EPA's criteria documents as well as the resulting air quality standards. Before setting or revising a standard, EPA should be required to reconcile its findings with those of the scientific body evaluating those findings.

3. Make sure that NAAQS reflect the uncertainty in such factors as unique meteorological conditions, air quality monitoring and air quality computer modeling (these studies analyze air quality, climate, meteorology, terrain and vegetation). For example, the standards should allow more flexibility in "averaging times" for measuring air quality and "exceedances" — instances when the specified air quality limit is exceeded — to take into account natural occurrences.

4. Analyze additional costs and benefits and take regional differences into account in setting the "secondary standards" — designed to protect property, plants, aesthetics and other "public welfare" items.

Principal CAA Sections

Sec. 108	Criteria
Sec. 109	Standards
Sec. 302(h)	Definitions

Nonattainment Areas

General Policy Statement

Nonattainment areas should be brought into attainment with properly developed standards in a reasonable amount of time. However, emission reductions should not fall disproportionately on one category of sources. Moreover, permitting requirements for new sources should not be so strict or cumbersome that they preclude economic growth.

Current Situation

State plans in nonattainment areas have largely focused on the control of existing "stationary source emissions," any existing permanent facility. For proposed new facilities, EPA's "Offset Policy" has strongly influenced state and local regulations. Under this policy, applicants for new facilities must obtain offset credits. In other words, before a new facility can be approved, the applicant must find ways to eliminate more air pollution than the new facility would emit. Some states, rather than requiring companies to find offsets for new facilities, have created "growth allowances" for the future by generally requiring stricter controls on existing emission sources. These allowances are then awarded at the state's discretion.

These approaches to nonattainment areas may hinder both orderly economic growth and the development of domestic energy resources.

- In many areas where domestic energy development is most likely to occur, offsets may be very difficult to obtain or simply not available.
- The overall offset requirements are extremely complex.
- A company must demonstrate that the emissions it is reducing (the offset) provide a net air quality benefit compared to the emissions it will add.
- Litigation on minor points can stop or delay a project.

Moreover, arbitrary national statutory deadlines are unrealistic and inappropriate. Also, the construction ban as a means to enforce those deadlines or affect state plans is ineffective and punitive. It can cause significant harm to employment and local economies. The ban also can inhibit the progress toward meeting the air quality standards by preventing the replacement of old, inefficient polluting facilities. Other more effective mechanisms are available within the Act to achieve the same goals as the construction ban.

Recommendations

1. Allow states that cannot meet the national attainment dates for National Ambient Air Quality Standards, despite good faith efforts, to set attainment dates beyond the present deadlines as long as the state can project long-term progress.

2. Balance the need for offsets, in the preconstruction review, with other national goals such as the need to reduce dependence on foreign energy sources and the need to maintain a sound economy.

3. Reduce the complexity and scope of the nonattainment requirements through these modifications:

a. Require "Best Available Control Technology" (BACT) rather than "Lowest Achievable Emission Rate" (LAER); define BACT to be the same as "New Source Performance Standards" (NSPS), where NSPS exist.

b. Allow full use of the "bubble concept"; that is, allow an entire plant or even several nearby emission sources to be treated as one source insofar as possible. In that way, emissions could increase in one source if they decreased in another, without time-consuming and costly review.

c. Calculate emissions on a consistent basis.

d. Exclude fugitive dust, mobile source emissions and "secondary source emissions" (from trucks, businesses or other sources associated with a major facility).

e. Reduce delays associated with air quality monitoring and computer modeling requirements.

f. Limit new source review to new or modified sources that have net emission increases of nonattainment pollutants greater than 100 tons per year.

g. Eliminate the requirements that a company certify that all its facilities in the state are in compliance before a new permit is issued.

h. Repeal the demand for proof (Sec. 172[b] [11] [A]) that the benefits of a proposed new or modified source outweigh all environmental and social costs.

4. Eliminate the construction ban.

Principal CAA Sections

Sec. 110	State Implementation Plans
Sec. 171-178	Plan Requirements for Nonattainment Areas

Attainment Areas

"Prevention of Significant Deterioration"

General Policy

The "Prevention of Significant Deterioration" (PSD) program could be simplified without causing significant degradation in air quality. The PSD program should continue to protect the air quality in designated areas of the country that have unique national scenic values. The program should also continue to ensure that air quality in all attainment areas meets the National Ambient Air Quality Standards (NAAQS).

Current Situation

The PSD program added by the 1977 Amendments to the Clean Air Act is exceedingly complex and represents an altogether different approach to protecting air quality than the NAAQS. It creates three classes of attainment (PSD) areas: one intended to preserve the special characteristics of the national parks and other sensitive areas (Class I), and two intended to regulate growth of emitting facilities—even with the best emission controls—in other areas (Class II and Class III).

The current PSD program limits the extent to which air quality degradation may exceed the levels determined by measuring existing or "baseline" air quality in each PSD area as of a certain date. These limitations, or "increments," currently apply only to two of the seven regulated pollutants: total suspended particulates and sulfur dioxide ("Set I" pollutants). Those increments are set by statute and cannot be exceeded even if air quality in an area is much better than the ambient air quality standard. Those seeking permits must also demonstrate, through extensive air quality monitoring and computer modeling, that the proposed new or modified facility will not adversely impact the air quality in any nearby areas designated as Class I.

Recommendations

1. Require, in place of the current increment system, a combination of "Best Available Control Technology" (BACT) and a review against NAAQS for new or modified facilities that would increase emissions of the specified pollutants more than the 100 and 250 ton-per-year thresholds specified in the Act.

2. Require, in areas having national unique scenic values, an additional air quality review to preserve those scenic values.

a. Congress shall identify those specific areas that have national unique scenic values.

b. For new or modified facilities that affect air quality in areas having national unique scenic values, this review should balance scenic values with other national goals, such as the need to reduce dependence on foreign oil from insecure sources.

3. Develop, before imposing visibility requirements, an adequate scientific basis for analyzing and measuring visibility impairment.

4. Modify PSD preconstruction requirements to:

a. Define BACT to be the same as "New Source Performance Standards" (NSPS), where NSPS exist.

b. Allow full use of the "bubble concept"; that is, allow an entire plant or even several nearby emission sources to be treated as one source, insofar as possible.

c. Calculate emissions on a consistent basis.

d. Exclude fugitive dust, mobile source emissions and "secondary source emissions" (from trucks, businesses or other sources associated with a major facility).

e. Reduce delays associated with air quality monitoring and computer modeling requirements.

5. Do not extend the PSD program to regulate "Set II" pollutants (hydrocarbons, carbon monoxide, ozone, nitrogen oxides and lead). The existing PSD program requires BACT and air quality analyses for these pollutants. These requirements, coupled with efforts to reduce mobile source emissions, sufficiently protect attainment areas.

Principal CAA Sections

Sec. 110 State Implementation Plans
Sec. 160-169A PSD

Government Permitting Procedures and Requirements

General Policy

The Act should provide an efficient means of securing permits. An efficient permit review process would speed progress in improving air quality by accelerating replacement of older facilities with newer facilities that have better pollution-control equipment.

Information requirements for permits should be publicly specified. Once the application has been submitted, a prompt decision should be required. Overlapping jurisdiction (federal, state, local) should be eliminated, with only a single review required for a project.

Current Situation

The Act established detailed permit review and approval requirements before a company is able to construct large new facilities or modify existing facilities. This highly complex and cumbersome permitting process results in significant uncertainty and delay. Right now, the permit-processing time to build a new facility or modify an existing one frequently is three years or more. The time-span includes planning, monitoring, agency review and public hearings.

In the future, the time required to secure permits before construction will likely increase for these reasons:

- monitoring will be required for more pollutants;
- accounting for increments for "Prevention of Significant Deterioration" (PSD) will become more complex as more companies try to build in an area; and
- more air quality computer modeling may be required for facilities proposed for rough terrain.

Furthermore, the permit review before construction is conducted separately for each pollutant. The attainment or nonattainment status of an area is first determined for each major pollutant. Then, if the area has attained the standard for the pollutant, the permitting process for the pollutant must be in accordance with the review requirements for PSD. If the area has not attained the standard for the pollutant, the permitting process must be in accordance with the nonattainment review process.

Under this system, a new source may:

- Undergo a PSD review for one pollutant, a nonattainment review for another pollutant and possibly both a PSD and a nonattainment review for any single pollutant.
- Be subject to reviews by both federal and state authorities, each of which has somewhat different requirements.

Additional problems in the permitting process are:

- Delays by agencies in determining whether the application is complete.
- Delays in determining "baseline" air quality.
- Delays in scheduling public hearings.
- Uncertainty in air quality modeling and monitoring requirements.
- Changes in the requirements for data and analysis.

Recommendations

1. Merge the separate PSD and nonattainment review processes into a single air quality permit review procedure by the states.

2. Require the use of available data to determine background pollution levels.

3. Eliminate federal review of individual actions by states.

4. Specify time limits for agencies to determine if an application is complete; once that is done, specify time limits for issuing the final permit.

5. Allow construction to begin, at the applicant's risk, before the preconstruction permit review is completed.

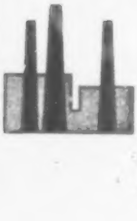
6. Make any new or changed technology standard effective on the date the standard is put into force, rather than making it retroactive to the date the standard is proposed.

7. Do not make permitting requirements more stringent while the permit application is under review.

8. Exempt new and modified sources from additional emission control requirements during construction of the facility and for 10 years after start-up of the project.

Principal CAA Sections

Sec. 110	State Implementation Plans
Sec. 111	New Source Standards
Sec. 165	Preconstruction Requirements
Sec. 167	Prevention of Significant Deterioration Enforcement
Sec. 168	Period Before State Implementation Plan Approval
Sec. 169A	Visibility
Sec. 172	Nonattainment Plan Provisions
Sec. 173	Permit Requirements—Nonattainment



Use of Economic Criteria

General Policy

The Act should recognize and take into account economic criteria both in setting standards and in issuing regulations. Economic criteria include the use of cost-benefit, cost-effectiveness and equity considerations.

Current Situation

The Act is ambivalent about the use of economic criteria in setting and implementing standards. Costs are generally ignored in setting ambient air quality standards, schedules and deadlines. The main exceptions relate to:

- technology standard setting (e.g., "New Source Performance Standards" and "Best Available Control Technology"), which requires that costs be considered but does not explicitly require that trade-offs be taken into account; and
- other minor provisions of the Act, where adverse economic effects (e.g., unemployment and economic disruptions) may justify modification or suspension of some provisions of the Act.

Recommendations

1. Strengthen and expand the Act to require that EPA conduct an economic impact assessment, including the impact on energy development, for all proposed major standards and regulations before they are proposed, issued or implemented.

2. Strengthen the system of peer review and evaluation of EPA's economic and energy-related studies.

3. Require periodic review (every five years) of:
   a. the additional costs and benefits of existing standards; and
   b. the cost-effectiveness of existing rules and regulations.

Principal CAA Section

Sec. 317 Economic Impact Assessment

Hazardous Air Pollutants

General Policy

Hazardous pollutants that pose a significant risk of serious harm should be regulated. Development of these regulations should be based on sound scientific evidence, appropriate risk assessments, consideration of regulatory options, and analyses of the cost-effectiveness of different control technologies.

Current Situation

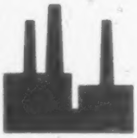
The Act sets forth a procedure for regulating hazardous air pollutants. Such pollutants are those "which may reasonably be anticipated to result in an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness." National emissions standards for hazardous pollutants are to be set at the level that provides an ample margin of safety to protect public health.

To date, seven substances have been listed as hazardous pollutants, and four have been regulated. However, as public concern has shifted toward toxic substances and environmental carcinogens, EPA has been pressured to expand the list of hazardous pollutants and the National Emission Standards for Hazardous Air Pollutants (NESHAPS) program.

EPA proposed, in October 1979, an airborne carcinogen policy which could lead potentially to NESHAPS for more than 100 pollutants. The Act provides little-to-no guidance on the types of substances EPA should list and regulate as hazardous pollutants. EPA has interpreted its mandate as requiring it to determine a very low, minimum risk threshold for listing.

A literal reading of the Act requires EPA to set a *single* emission standard for all sources (new and existing) of a listed pollutant. EPA, however, has implemented NESHAPS by proposing *several* standards (for individual sources or source categories) for each pollutant.

Moreover, the Act requires EPA to set each emission standard in an unreasonably short time.



Recommendations

1. Define clearly the term "hazardous air pollutant." The definition should be: an air pollutant to which no ambient air quality standard is applicable, which causes or contributes to air pollution and which may reasonably be anticipated to result in a substantial increase in the risk of mortality or a substantial increase in the risk of serious irreversible or incapacitating reversible illness.

2. Prescribe, under the Act, a listing procedure that comprises the following:

   a. a quantitative risk assessment based on the best risk and exposure evidence available;

   b. a preliminary "option analysis" which assesses available regulatory alternatives;

   c. publication of a proposed listing in the *Federal Register*, with support material identified, accessible and open to review and comment by the Science Advisory Board and the public; and

   d. opportunity for expedited judicial review of final listing decisions.

3. Require, under the Act, that emission standards for hazardous pollutants be set at levels that protect the public from significant risk of harm. Require that EPA, in setting emission standards for hazardous pollutants, evaluate the various technologically feasible control alternatives, the health benefits of these alternatives and the economic, energy and environmental consequences.

4. Establish a final emission standard within a reasonable period of time after a pollutant is listed as a hazardous air pollutant. This requirement would not apply if the EPA administrator were to find, on the basis of additional information, that the pollutant should not have been listed.

Principal CAA Sections

Sec. 112 National Emission Standards for Hazardous Air Pollutants

Sec. 302(g) (j) (k) Definitions

Acid Precipitation

General Policy

The causes and effects of acid precipitation need further research. Such research programs (including the one recently mandated by Congress) should analyze the problem in a sound, scientific manner.

This research should cover:

- trends in the acidity of precipitation (rain, snow);
- the source, chemical formation and transport of acid precipitation;
- the effects of acid precipitation on lakes, fish and other measures of public welfare; and
- systems to alleviate acid precipitation, including land and water management.

Until more complete scientific investigation is carried out, additional legislation or regulation would not be prudent.

Current Situation

A number of lakes in the northeast United States and Canada are reported to be increasing in acidity to the point that some of them no longer support fish life. Precipitation in those areas is reported to be more acidic than normal.

The EPA, some northeastern states, Canada and a number of environmental groups are calling for additional legislative or regulatory action to reduce the possible impact of acid rain.

Scientific evidence is not conclusive enough to support the claim of increasing acidity of precipitation.

The Clean Air Scientific Advisory Committee concluded (in November 1980) that there was insufficient scientific basis to identify the contribution of man-made sources of acidity in precipitation or to set or modify air quality standards because of acid precipitation. Thus, Congress recently funded a 10-year study of acid rain.

Recommendations

1. Include, as a major effort in research on ways to control the effects of acid precipitation, work on land and water management practices that would minimize the effects of acid precipitation. Require that federal government research programs be periodically reviewed and, if needed, revised.

2. Require in the Act that any standards and regulations that may be designed to control acid precipitation be cost effective and be based on sound scientific studies that would undergo peer review.

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ARCO Alaska, Inc.

CLEAN AIR ACT TESTIMONY

July 1, 1981 Fairbanks, Alaska

Good morning Mr. Chairman. My name is Robert A. Crosky. I am Vice President and Manager of Alaska Affairs for ARCO Alaska, Inc., a subsidiary of Atlantic Richfield Company. I am here today on behalf of Atlantic Richfield Company to share with you our concerns regarding the Clean Air Act and its effects on energy and mineral development activities in Alaska.

Our Company is continuing to make substantial commitments in the State of Alaska. We are one of two operators of the Prudhoe Bay Field, and are now developing the Kuparuk Field, both of which are located on the North Slope. We also have oil and gas operations onshore and offshore in the Upper Cook Inlet area and have significant leasehold interests in many other areas of Alaska, including the Gulf of Alaska, the Lower Cook Inlet, the Beaufort Sea, and the North Slope. Our Anaconda subsidiary has significant mineral mining projects in process and in planning within the state. In total, our past and potential future commitments in Alaska can be measured in the many billions of dollars.

In addition to our extensive Alaskan activities, Atlantic Richfield has considerable operations throughout the remainder of the United States which are also vitally affected by the Clean Air Act. As a result, many hours have been spent by experts throughout the Company developing an overall Company position concerning the Clean Air Act re-authorization and re-evaluation presently underway in Congress. A copy of this position paper is attached to this testimony for the record. Today, I want to direct my remarks toward two specific aspects of the present federal clean air program--Prevention of Significant Deterioration (PSD) and the recently promulgated visibility regulations--with particular reference to our present Prudhoe Bay and Kuparuk projects.

In general, it has been our experience that the complexities of the PSD program have forced us to divert considerable professional expertise into negotiating a maze of regulations rather than working to minimize potentially adverse environmental consequences of our projects in national air quality attainment areas. The costs to obtain Prudhoe Bay and Kuparuk PSD permits total approximately $2.5 million to date, not one cent of which was spent on actually maintaining or improving air quality. Instead, this $2.5 million was spent on required air quality modeling, ambient air monitoring, and other expenses associated with preparation of PSD permit applications. We believe that there has been no discernible benefit from this procedure, which has been to a large extent a very poor waste of time, talent, and money.

Furthermore, it is important to note that the long lead time inherent in the PSD permitting process forces premature decision-making by the applicant, including the specification of processes and equipment, which frequently have to be revised later as additional information becomes available. Revisions in the scope and design of a project are normal and result from on-going engineering design studies, changing operations and field plans, equipment availability, and technological developments. As a result, permits frequently have to be modified or new permits may be required. Recently at Prudhoe Bay, design studies indicated a requirement for a turbine mass mover which was originally permitted at Flow Station 1 was actually needed at Flow Station 2. A permit alteration was required which was actually handled by another PSD application. In addition, each of these changes generally require further documentation and require computer modeling in order to evaluate the impact of these changes on air quality so as to enable the Environmental Protection Agency (EPA) to reach a final decision on the new or modified permit. In the Waterflood project, a major permit modification of the PSD permit was required when it was determined that the scope of the project had changed. Initially, the water being injected into the oil bearing strata was to be heated to 40° F. Further studies showed that the water needed to be heated to 80° F, requiring more heating equipment than was originally planned. This design change required extensive modification of the permit, including computer modeling costing more than $30,000. The permitting process under PSD is further complicated since prudent management is reluctant to make sizeable capital expenditures until all essential permits are obtained. If delays are encountered from new or modified permits, this process, as a worst case, can ensnare an otherwise acceptable project in a never ending cycle of permit modifications and delays. Fortunately to date, we have not had such an experience in Alaska due to the diligent efforts of all parties involved.

We have further concern regarding pre-construction ambient air quality monitoring requirements. Under the revised PSD regulations promulgated subsequent to Alabama Power, et al. vs. Costle court decision, one year air monitoring, representative of the year preceding the PSD application, can be required by EPA, effective February 7, 1982. Thus, additional monitoring may be required for major modification of a source even if ambient air monitoring has been conducted previously. The benefit of this monitoring requirement is dubious in known pristine areas such as the North Slope and other frontier areas of Alaska, and therefore, serves only to increase costs and delay development projects in such areas.

Again, we feel that the expense in time and manpower inherent in the current PSD permitting process is much too high a price to pay for the results obtained. All these efforts do not contribute to enhanced air quality. We, and the agencies, must apply considerable professional expertise to work through a regulatory jigsaw puzzle rather than devoting our combined talents to technological innovation or other productive work more likely to improve or maintain air quality.

We Alaskans have a valuable resource in our clean air, and we continue to strongly support protection of human health as it may be affected by the quality of air resources in Alaska. But, we believe it is in the national interest that the PSD permitting process be streamlined and simplified as set forth in our Company position paper, so that needed energy and mineral development can proceed expeditiously.

In addition to the permitting process, the current PSD increment standards are in fact discriminatory because they subject Alaska and other attainment areas to unnecessarily stringent standards. The primary and secondary national ambient air quality standards (NAAQS) were mandated to protect public health and welfare, with an "adequate margin of safety." These standards prescribe uniform levels of air quality to be maintained throughout the United States. But the PSD increments are actually another layer of standards that disregards the adequate margin of safety already provided by the NAAQS for health and welfare protection. Thus, areas such as Alaska that enjoy clean air are unfairly prohibited from economic development by an air quality standard that in fact prohibits certain land uses. In our view, since primary and secondary ambient standards are already designed to protect public health and welfare, imposition of more standards under PSD does not have any reasonable relation to known or anticipated risks from air pollution.

Finally, a major concern of our Anaconda subsidiary involves burdensome control requirements. Specifically, the total suspended particulate (TSP) standard, as presently defined, regulates both man-made and naturally occurring substances that carry no known adverse health effects. As a result, ordinary mine dust and haul road dust must be controlled, at a substantial cost, with no resulting health benefits, and all such matter is included in the calculation of the allowable increments for a given project.

Therefore, given these concerns, we recommend the following reforms to the present PSD program:

(1) Delete the Class II and Clase III increments. Retain Class I increments, based on annual averages of criteria pollutant emissions, for those areas of nationally unique scenic value.

(2) For all attainment areas other than Class I, require BACT, consistent with New Source Performance Standards (NSPS) where applicable, so that the standards accomodate reasonable, cost effective alternatives.

(3) Provide for Class I areas a reasonable, administratively effective variance procedure for energy and mineral exploration and development activities which utilize Best Available Control Technology (BACT).

(4) Mandate more expeditious administrative procedures by requiring more stringent time frames for permit processing.

(5) In lieu of the existing standard for total suspended particulate matter, establish a fine (respirable), health-based particulate standard, leaving non-respirable standards to be set by the states according to regional circumstances.

(6) For future Class I designations, the overall national interest should be considered, thus including thorough evaluation of social, economic, energy, and mineral resource factors as well as the aesthetic air quality.

The second aspect of the Clean Air Act I wish to discuss is Section 169(A) of the Act which declares that it is a national goal to prevent future--and remedy any prior-impairment of visibility caused by man-made air pollution in mandatory Class I areas. Certainly, visibility is a natural resource worth protecting. The current regulatory program, however, contains several problems that should be resolved. Although to date restriction of our operations in Alaska due to visibility regulation has been minimal, the potential for significant adverse impact in the future is great.

In this regard, it should be noted that our activities in Alaska should not impair the visibility of any of the four mandatory Class I areas listed for the state at this time. But, if the "integral vistas" concept is implemented as has been proposed, which would extend the areas, oil and gas activities may be adversely affected. Furthermore, if additional Class I areas are designated in the State of Alaska and the air resources are found to be worthy of visibility protection, then the potential for this portion of the Clean Air Act to inhibit resource development will increase significantly.

We believe there are three major problems that make it difficult to regulate visibility.

The first problem involves an understanding of "visibility" itself. There are no reliable measures of visibility or visibility impairment. The pleasure associated with a scenic vista is a function of the human subject. For this reason, it seems impractical to regulate a resource--the value of which is aesthetic--if the change in that resource cannot be detected by any standard method.

Secondly, it is not possible to quantify man-induced as distinct from naturally occurring visibility impairment due to dust storms, fogs, or haze produced by the natural environment.

Finally, the EPA has taken the position that localities outside mandatory Class I areas should be subject to the National Visibility Goal. This position apparently conflicts with existing statutory language. If the EPA is allowed to require the view from Class I areas over outlying lands to be pristinely preserved, an implicit prohibition of all emissions affecting visibility as far as the eye could see under perfect conditions would result.

This will create the equivalent of a visibility "buffer zone" around Class I areas. Section 169(A)(e) of the Act clearly states that "in promulgating regulations under this section the Administrator shall not require the use of any automatic buffer zones."

To address properly the above concerns regarding the recently promulgated visibility regulations, Atlantic Richfield Company recommends the following actions be taken:

(1) The visibility regulations and subsequent guidelines from the EPA should be rescinded.

(2) Research into the science of visibility and the causes of visibility impairment should be accelerated.

(3) Visibility regulations should not include the "integral vista" concept. Prevention and remedy of visibility impairment should occur in Class I areas not from Class I areas.

Any realistic regulation of visibility impairment must depend on an appropriate determination of acceptable effects on visibility. Without question, visibility is a natural resource worth protecting. The question becomes what degree of visibility and at what cost? Research into the visibility question, therefore, must address this issue and devise mechanisms to balance social, economic, and environmental considerations from a national as well as local perspective.

In conclusion, we believe there are a number of specific areas in the Clean Air Act and its implementing regulations which should be modified to balance economic growth, and resource development in particular, with protection of the nation's air quality. We again encourage your careful consideration of the Atlantic Richfield Company position paper attached, which provides a more thorough review of each of these problem areas and recommends appropriate corrective action.

Thank you very much.

ATLANTIC RICHFIELD COMPANY POSITION
CLEAN AIR ACT REAUTHORIZATION 1981
EXECUTIVE SUMMARY

Atlantic Richfield Company supports specific changes to the Clean Air Act in order to maintain protection of the public health and to balance competing welfare-based interests of the Nation. We believe the changes highlighted below would enhance health protection in accordance with objectively determined scientific judgments; promote efficient development of the Nation's productive capacity and, in particular, of strategic natural resources; reorient environmental expertise in the public and private sectors away from bureaucratic procedures *per se* toward efficient management of technological change; reduce the adversarial nature of present environmental regulation, and facilitate consensus about effective environmental protection.

I. NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

- Strengthen the independent process for reviewing the scientific basis of NAAQS, as well as other research-related aspects of the Act.
- In applying short-term standards on a pollutant-specific basis, implementation programs should exclude exceedances caused by naturally occurring phenomena beyond human control.
- After EPA has adopted or revised a criteria document, allow states to set secondary NAAQS in accord with specific characteristics of localities.
- In lieu of the existing standard for total suspended particulate, establish a fine (respirable) particulate standard, with secondary (non-respirable) particulate standards to be set by the states.

II. PREVENTION OF SIGNIFICANT DETERIORATION (PSD)

- Retain Class I increments, based on annual averages of Set I criteria pollutant emissions only for areas having recognized national unique scenic values. Such areas should be redefined by Congress.
- For future Class I designations, require thorough evaluation of socio-economic and energy/mineral resource factors in addition to aesthetic qualities.
- Provide reasonable variances, that are administratively effective, for energy/mineral resource development affecting Class I areas in cases where exploration and development could exceed Class I emission increments during the development.

- For all attainment areas other than Class I, eliminate increment systems and require Best Available Control Technology (BACT), consistent with New Source Performance Standards (NSPS) where applicable.

III. VISIBILITY

- Rescind EPA's recently promulgated visibility regulations.

- Reiterate express Congressional intent that visibility regulation should extend to impairment within Class I areas, not from Class I areas.

- Accelerate EPA research to develop a conceptual and technical basis for visibility regulation sufficiently flexible to balance socio-economic needs, specific physical characteristics, season, time of day, frequency, duration, intensity and the subjective nature of human perception.

IV. ACID PRECIPITATION (LONG RANGE TRANSPORT)

- Accelerate mandated research concerning etiology and effects of acid deposition.

- Refrain from any premature effort at remedial regulation.

V. NSPS

- For coal-fired power plants, substitute a single SO_2 emission standard (on a *per* BTU basis) for the present percent reduction requirement.

- NSPS standards should be effective upon promulgation, not retroactive to the date of proposal.

- Remove the NSPS requirement for reconstructed facilities where no significant increase in emissions will occur.

VI. EMISSION OFFSETS/BUBBLE POLICY

- Mandate EPA'S proposed extension of a uniform definition of "source" to apply to non-attainment areas as well as attainment areas.

- Simplify the existing source bubble approval process by allowing regional EPA or appropriate state officials to give complete approval to a given offset emissions plan.

VII. REGULATION OF ATMOSPHERIC EMISSIONS FROM MARINE VESSELS

- Require demonstration of the need for marine emission controls, consistent with thorough study of ambient air effects of vessel emissions.

- Mandate federal preemption of state and local regulation of marine emissions, in order to insure consistency, through the agency of the U.S. Coast Guard.

VIII. NON-ATTAINMENT AREAS

- Offsets at best can be used as an interim measure. If they are to be retained, a flexible banking policy allowing long-term "deposits" and free trading between firms within an AQCR should be instituted to facilitate offset/bubble programs. Where synergistic effects are a concern (such as the NO-HC-Ozone relation) interpollutant tradeoffs should be an option.

- Rescind construction bans in non-attainment areas in those cases where the reason for non-attainment is predominantly unrelated to stationary sources.

- In applying short-term ambient standards, the Act should exclude exceedances caused by naturally occurring phenomena beyond human control.

IX. HAZARDOUS AIR POLLUTANTS (SECTION 112)

- Preserve the procedural and substantive scientific stringency of the standard setting process presently used under Section 112.

- If amendments are made to Section 112, mandate administrative flexibility to list substances under Section 112 according to certain source categories, and to establish standard-setting priorities among categories on a cost-effective basis.

- If amendments are made to Section 112, clarify the Administrator's ability to remove substances from Section 112 listing completely or according to specific source category.

- If amendments are made to Section 112, eliminate the arbitrary one year timetable for standard setting.

X. REGULATION OF FUELS (SECTION 211)

- Amend Section 211 to allow generic criteria to be established for the introduction of new fuels, blending components and fuel additives.

- Establish standardized analytical monitoring procedures and tests, including repeatability and reproducibility limits.

ATLANTIC RICHFIELD POSITION:
CLEAN AIR ACT REAUTHORIZATION 1981

As a diversified natural resources company concentrating in domestic crude oil and natural gas exploration and production, petroleum refining and petrochemical production, extraction of coal, copper and other minerals and manufacture of finished products, Atlantic Richfield Company is well suited to address the problems and challenges posed by ambient air protection. During the past ten years, in a variety of public forums and activities, we have consistently expressed a commitment to protection of human health, as it is affected by the quality of the Nation's air resources. We have further supported protection of human and environmental welfare as they are affected by air pollution.

Thus, on the occasion of the Clean Air Act's Congressional reauthorization during 1981, Atlantic Richfield supports continued protection of both health and welfare. We do strongly believe, however, that specific, albeit substantial, changes in the Act must be made, not only to realize its primary health-based protective intent, but also to clarify and balance competing welfare-related claims.

Such a balance will doubtless require great Congressional effort. Thus far, the net effect of the Clean Air Act's administration, with respect to prospective stationary sources, has been to delay reasonable economic development through redundant permitting procedures, and to transform the statute into a blunt instrument of federal land management of relatively undeveloped areas. Indeed, Atlantic Richfield's energy and mineral resource development programs face severe constraints -- if the land management effect of the Clean Air Act is not modified to permit prudent resource development.

While the historical adverse effects upon our operations, due to the labyrinthian regulation under the Act, are not amenable to precise quantification, these administrative burdens are major in terms of cost, deferred projects and productive capability. The inflated cost alone, of capital due to permitting delays on large projects, is substantial. Indeed, management's awareness of regulatory burdens has in many instances stopped possible new projects. In general, American management has grown reluctant to commit substantial engineering or research capital to a project before environmental approval is gained. Thus, while it might appear that a project has not been delayed by environmental constraints because substantial time would have been required for engineering design anyway, the reality is that many projects suffer "built-in" delays which obscure real regulation-related costs.

Through its unnecessary complexity the Act has required development of a shadow bureaucracy within most major companies to deal with a veritable "paper chase" that diverts professional expertise into negotiating a bewildering maze of regulations rather than minimizing effectively adverse environmental consequences of technological processes. Atlantic Richfield believes that environmental goals can be achieved without regulatory-induced economic stagnation and offers the accompanying suggestions to improve the existing process.

Finally, as originally stated in the Clean Air Act, the states should be given the key role in managing their ambient air resources, where such delegation does not jeopardize public health.

It is with such considerations in mind that Atlantic Richfield proposes changes to the Clean Air Act detailed below. We believe these changes are consonant with the following goals:

(1) Continued emphasis on the protection of public health based upon sound scientific evidence, which is less marked by political expediency, unachievable technology, adverse capital formation time frames and unsubstantiated margins of safety (zero risk).

(2) Re-evaluation of the philosophy of national welfare standards in lieu of the need to balance localized welfare protection, socio-economic and national security issues, in concert with the development of the nation's productive capacity.

(3) Streamlining of the bureaucratic procedures and marginal regulations that afford no measure of environmental protection *per se* but add significant cost, delay and risk to reindustrialization.

(4) Rejection of the adversarial atmosphere that has pervaded resource development and environmental protection issues. Legislative and regulatory bodies, courts, industry, special interest groups, and the general public should work together to assure that legislative and regulatory development adopts a process of structured and objective problem solving and decision making.

I. NAAQS

1. Independent Scientific Peer Review

Sections 108 (Criteria Control Techniques), Section 109 (Standards) and all related aspects of research and technology development in the Clean Air Act provide for establishing scientific information about impacts of air pollution on public health and welfare. The Science Advisory Board (SAB) and National Air Pollution Control Techniques Advisory Committee in concert are presumably meant to fulfill the provisions of Sections 108 and 109 of the Act. But the scrutiny one would expect to be given to policy, standard setting, reserach, etc., as required by Section 117 of the Act, has not been forthcoming to date.

Clearly, independent, scientific peer review of National Ambient Air Quality Standards (NAAQS) setting and other standard settings (i.e. NSPS, BACT, etc.) is needed, in order that the highest standards of scientific rigor and knowledge are maintained throughout the rulemaking process. Indeed, independent scientific peer review would ameliorate the politics of environmental regulation, which often work at cross purposes to the overall public interest.

Atlantic Richfield, therefore, recommends that Congress clarify the intent of Section 117 of the Act and strengthen its provisions to assure that independent review is accomplished, oversight is provided, and full policymaking consideration be given to SAB recommendations. Specifically, EPA staff policy drafts concerning the standards should be reviewed and EPA staff required to respond on the record to any scientifically-based criticisms. On proposal of standards, the full record of criticism and response should be available for public review and comment.

2. Total Suspended Particulates

Since ambient standards are intended to protect the public health and welfare, regulatory process under the Act should focus on those pollutants which present some known or reasonably anticipated adverse effect on public health or welfare. However, the existing total suspended particulate (TSP) ambient standard, because of its definition, regulates manmade and naturally occurring substances that have no known adverse health effects. The TSP standard governs all particulate matter in the air, whatever its composition, up to a particle size of 100 microns. Unlike other ambient standards which govern specific chemical compounds or groups of compounds, the particulate standard deals only with the weight and concentrations of all particulate matter, and not its composition. As a result, ordinary road dust, for example, is governed by this standard, and it is currently regulated.

The health threat posed by airborne particle pollutants is that they might be inhaled and deposited in the respiratory tract or ingested and deposited somewhere in the digestive system. It is primarily on this basis that EPA developed the current particulate standard.

Upon reviewing all available health studies, however, we have thus far found no credible evidence suggesting that particles any larger than 10-15 microns in diameter are likely to enter the respiratory system. Furthermore, there is little or no evidence suggesting that ingestion of any larger particle *per se* poses a perceptible threat to human health. In many areas of the country, however, much naturally occurring wind-blown dust is captured by the high-volume samplers currently used to measure ambient particulate levels. (In fact, the samplers often pick-up small chunks of leaves and twigs, and the standard operating procedure indicates that these are to be picked out of the sampler by hand.) It is therefore not surprising to find that desert areas, located far from any emission source, "violate" ambient particulate standards -- not because of any man-made pollution in the area or any threat to public health, but because desert winds blow sand into the sampling chamber. Since some of the most healthful climates are found in the Western United States, the current particulate standard is clearly regulating beyond the need to protect the health and welfare, and is in reality subjecting many healthful areas to the non-attainment provisions of the Act without good cause.

For these reasons, Atlantic Richfield recommends that an inhalable particulate matter (IPM) standard be mandated to replace the current TSP standard.

There is concern that an IPM standard would result in increased retrofitting costs to certain segments of industry. Health studies to date, however, indicate that this should not be a problem. One of the few reliable measures of IPM effects on public health is the British approach, which considers IPM exclusively. Almost without exception, the evidence shows that if IPM were regulated and corresponding health protective ambient levels were converted to

American monitoring methods by accepted conversion factors, the present particulate standard could be relaxed - with no risks to public health - by approximately a factor of two. Thus there is at present no credible health basis for more restrictive emission controls of IPM.

Shifting to a fine particulate standard would not in itself prevent regulation of the large particles as part of a secondary (general welfare) standard. In order to insure welfare protection, a secondary standard for non-respirable particulates could be required on a local basis. Such secondary standards should be drawn to take into account the contribution made by naturally occurring sources of non-respirable particulates.

3. Short-Term NAAQS

In order to facilitate reasonable air quality monitoring and balance the cost of technological compliance, Atlantic Richfield recommends that Congress amend Section 109 to require EPA, on a pollutant-by-pollutant basis, to exclude from consideration exceedances of short-term NAAQS resulting from unusual meteorological conditions, natural pollutant concentrations and other factors beyond human control or cause.

4. Secondary NAAQS

Since welfare effects vary locally, due to such factors as types of crops grown, natural resources in place and employment/density levels, Atlantic Richfield recommends that Congress amend Section 109 to expand the authority of each state to establish its own secondary NAAQS, in lieu of EPA's secondary NAAQS. Currently, states are free to adopt more stringent standards than EPA sets; states should be free, however, to adopt less stringent standards where concerns of overall welfare make the latter appropriate, and where, by definition, public health is already protected by the primary standards.

II. PREVENTION OF SIGNIFICANT DETERIORATION (PSD)

As expressed by Congress in Part C of the Act, the purposes of the Prevention of Significant Deterioration (PSD) program are "...to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural recreational, scenic or historic value."

The execution of PSD, however, extends far beyond these legitimate concerns.

Perhaps the most critical recurring administrative PSD problem involves delay in the preparation, completion and approval of operation and construction permit applications. Since extensive computer modeling is often required, a source must justify its proposed location on the basis of intricate and detailed computer analyses. These analyses must be reviewed by the relevant state and sometimes the federal permitting authority, and often air pollution engineers will differ on particular assumptions in a given analysis. The differences often require complete re-evaluation and resubmission of the permit application.

In a broader context, PSD, as currently applied, is discriminatory, because it subjects parts of the country to needless, stringent and artificial ambient standards. Originally, ambient standards were developed to protect public health and welfare by prescribing requisite uniform levels of air quality to be maintained everywhere in the nation. The original intent was to prevent the states from "bidding" for new industry by relaxing air quality requirements to the detriment of the health of their citizens. The current PSD requirements, particularly the Class II and Class III designations, defeat the original intent of national standards. By requiring a level of air quality superior to ambient standards (which already ensure the protection of health and welfare), PSD unfairly penalizes areas with healthful air. PSD restricts them in attracting significant construction of major new efficient pollution-control-efficient facilities by forbidding them use of all available atmospheric resources up to the level mandated by ambient standards. Since ambient standards are already designed to protect public health and welfare, imposition of more stringent ambient levels is not protecting public health from any known or reasonably anticipated risk of air pollution. In fact, PSD is really a federal land-use regulation in the form of air-quality zoning, since it prohibits construction of a new facility on the basis of arbitrary air quality goals that have nothing to do with public health.

If the purpose of PSD is to protect air quality that is superior to the national standards, then a preferable alternative approach would be to require a new major source seeking to locate in an area to install the best available pollution control technology (BACT). Such an approach would encourage the phasing out of older high-polluting sources which produce inefficiently and which expose major segments of the population to ambient pollution levels which EPA believes are unhealthful. Furthermore, PSD has the actual effect of discouraging plant turnover, thereby prolonging the life of older, highly polluting facilities that could otherwise be replaced by new pollution-control-efficient facilities.

For these reasons, Atlantic Richfield endorses the following changes in the Nation's approach to prevention of significant deterioration of air quality:

(1) Retain a Class I increment designation only for areas having recognized national unique scenic values, such as national parks and monuments. The increment system would not be applied to other attainment areas. In Class I areas, increments should be limited to annual averages. Pollutants subject to PSD should only include criteria pollutants -- by definition, those pollutants which the Administration has found adversely affect public health and welfare.

(2) In designating future Class I areas, the overall national interest should be considered. Current procedures for designating Class I areas (which allow little or no industrial or energy development) do not take into consideration such factors as the effect on energy and mineral development and on local socio-economic needs. Rather, the only consideration is aesthetic air quality. Some aspects of energy and mineral development -- particularly resource extraction -- can only occur where resource deposits exist. Consequently, these and other factors which affect the national interest should be considered before designating new Class I PSD areas.

(3) Eliminate the numerically arbitrary Class II and Class III designations and increments in favor of a program to protect public health and welfare through the use of ambient air quality standards, as the Act originally envisioned, and retain BACT for new major sources.

If adopted, these changes in PSD would reduce delays, costs, uncertainties and "arbitrariness" involved with the current regulatory review process while ensuring the integrity of pristine areas and the maintenance of national ambient air quality standards. The following summarizes key points of the suggested program:

- New source review under the program would be required only for major sources of criteria pollutants seeking to locate within or near pristine areas or where violation of primary or secondary national ambient standards is a distinct possibility. In the event of the latter, new source review would be required only with respect to the particular pollutant(s) in question.
- Liberal trade-off policies would be allowed in attainment areas as another means of constructing a new major source. That is, a source seeking either modification or an entirely new site in an attainment area should be allowed to count offsetting emission reductions from other facilities in the same area in determining emission increases from the activity proposed.
- Best available control technology (BACT), realistic and equivalent to new source performance standards (NSPS) where applicable, would be required for all new major sources. With respect to projects for which no NSPS exist, BACT should be established on a case-by-case basis.

The current "full PSD review" would be required only for those sources seeking to locate in or near Class I areas or if they imminently threaten NAAQS. This review would be similar to the current format, with one significant difference. Variances which should be defined before-hand would be applicable to energy and mineral exploration and development operations in those cases where such activities could violate Class I increments for the duration of the project. Of course, variances would be allowed only if projects installed BACT. Such variances are necessary if domestic energy and mineral resources are to be used effectively to help provide for the critical energy and mineral security of the Nation. Indeed, a national study should be authorized to review the adverse effects of the Class I increment system on energy and strategic mineral development.

Such reform would accomplish two useful functions. First, it would eliminate most of the inherent error in attempting to extrapolate air quality from observed or calculated emissions. The focus would be on emission control, rather than on wasteful time-consuming and error-prone air quality analyses. Secondly, this approach would expedite considerably construction of new, pollution-control-efficient facilities in areas away from major population centers. This would, in turn, speed attainment and maintenance of national ambient standards in highly industrialized areas, as older high-polluting facilities are phased out.

For areas where existing air quality is near the secondary ambient standard for a given pollutant, an applicant could perform an air quality analysis to show that ambient standards would not be violated if the proposed source were approved. An alternative (and one which would be preferable), would be to allow use of internal or external offsetting emission reductions which, taken collectively with new source emissions, would show a net decrease, or no change in pollutant emissions. In this fashion, a more accurate emission inventory would be used as the basis of air quality control rather than speculative air quality models which are plagued by inherent and substantial errors.

This proposal relies upon BACT for major new and modified facilities and upon the states to develop monitoring data, since monitoring is necessary to establish that ambient standards are being met. Further, the federal and state ambient monitoring network must be improved, since only actual monitoring data can provide a realistic assessment of success in air pollution control. Small non-controversial sources should be exempt from pre-construction monitoring requirements. States should develop plans to reduce ambient concentrations, if NAAQS are threatened.

In summary, the PSD program proposed here has the following significant advantages:

- Reduces significantly the time and cost of agency review.
- Encourages construction of pollution-control-efficient sources.
- Minimizes substantial errors resulting from air quality modeling analyses.
- Protects public health and welfare while reducing significantly EPA's burden of data collection.
- In close cases, provides a more comprehensive analysis of air quality impacts of proposed new sources.
- Provides a mechanism for balancing the aesthetic component of public and environmental welfare with economic, energy, and strategic realities.
- Reaffirms the Clean Air Act's original approach that the primary concern of air pollution control is protecting the public health and welfare and the productive capacity of the Nation.

III. VISIBILITY

Section 169(A) of the Clean Air Act declares the national goal of preventing future (and remedying any prior) impairment of visibility caused by man-made air pollution in pristine federal enclaves (Class I areas).

At present, insufficient research has been accomplished toward creating a "science" of visibility: the fact is no reliable measures of visibility or visibility impairment exist. In this regard, however, it makes little sense to discuss visibility changes that cannot be detected by ordinary people. There is little sense (and much waste) in executing a regulatory program to prevent a change in visibility so minute that only exotic scientific equipment could detect it. The perception of impairment varies greatly among individuals, as does visual acuity itself. Because there is no objective scientific scale of visibility per se, one cannot know whether and to what extent visibility was "better" previously at any given place than it is today.

Moreover, one cannot quantify man-induced visibility impairment as opposed to naurally occurring phenomena such as dust storms, fogs, or, for that matter, haze produced naturally by forests.

To further complicate the visibility issue, EPA has taken the position that localities outside mandatory Class I areas should be subject to the national visibility goal, a position that apparently conflicts with existing statutory language. Certainly, the view in a pristine area might well extend for tens of miles or more in any direction. If one requires that the view from a Class I area over outlying lands be pristinely preserved, one is implicitly requiring a flat prohibition of all emissions affecting visibility for as far as the eye could see under perfect conditions. This would mean, in turn, that a non-Class I attainment area (in which development is allowed) adjacent to a Class I area would be prohibited from using its allowable increment for, say, particulates. The effect is the equivalent of a visibility "buffer zone" around Class I areas. Section 169(A)(e) of the Clean Air Act clearly stipulates that "in promulgating regulations under this section, the administrator shall not require the use of any automatic or uniform buffer zones."

Furthermore, prohibition of exploration, extraction, production, harvesting, and processing of natural resources in non Class I attainment areas contrary to Congressional intent, as expressed in the debate on Section 169(A), wherein such lands are continually referred to as "resource lands." Apparently, clarification is necessary.

For these reasons, Atlantic Richfield recommends the following:

(1) EPA's recently-promulgated visibility regulations and subsequent guidelines from EPA and other agencies should be rescinded.

(2) Research into the science of visibility and the causes of visibility impairment should be accelerated.

(3) Any visibility regulation should not include any "buffer zone" or "integral vista" concept; that is, prevention and remedy of visibility impairment should be in Class I areas and not from Class I areas.

With respect to any realistic regulation of visibility impairment, the key issue appears to be an appropriate determination of acceptable effects on visibility. Clearly, visibility is a national resource worth protecting -- but what degree of visibility at what cost. For example, it seems reasonable to determine whether perceptible visibility impairment 10 percent of the time is "acceptable" if it is a necessary consequence of energy development.

Research into visibility, therefore, should attempt to define a "baseline" consistent with legislative language. In this regard, the effects of season, time of day, frequency, duration, intensity and types of emissions on human perception should be analyzed. Regulation should proceed on the regional level. Finally, effective decision mechanisms for balancing socio-economic and aesthetic definitions of welfare should be created.

IV. ACID PRECIPITATION

Acid rain is allegedly caused by the mixing of pollutants with water vapor in the atmosphere, resulting in the formation of sulfuric acid and nitric acid. Acid precipitation is also alleged to cause damage to crops and forest products, as well as to fishing interests. Comparatively little research, however, has been performed and little information is known on acid rain, its causes and effects.

Because long range transport is a truly international problem involving windblown pollution, it must be addressed by international research and control efforts. Indeed, the Canadian and United States governments have begun cooperative work on this issue. Further cooperative and unilateral efforts towards understanding and dealing with acid rain should be encouraged and expanded. A provision of the recently enacted Energy Security Act supports the concept of more study. Unfortunately, pressure, abetted by simplistic media coverage, is being put on EPA to develop quickly regulations to address the acid rain issue.

Atlantic Richfield believes that coordinated research into the causes and effects of acid deposition, already initiated by Congressional legislation, should be accelerated. For the reasons outlined in the Introduction, however, we do not believe that regulation of acid rain, in the absence of detailed understanding of its causes and effects, constitutes sound public policy. Indeed, the history of the Clean Air Act already exemplifies the pitfalls of regulation arising from action without thorough understanding.

V. NSPS

Atlantic Richfield recommends that Congress correct a legislative provision of some import: the mandated percent SO_2 reduction that requires installation of stack gas scrubbers on all coal-fired boilers. The percent-reduction standard was largely the result of a political decision to "protect" high-sulfur eastern coal from competition with low-sulfur western coal for the coal-fired utility boiler markets. Other things being equal, low-sulfur coal may be somewhat higher priced, due to transportation costs. But its ability to meet ambient air quality standards without the use of scrubbers makes it highly competitive with lower priced high-sulfur coal, whose use entails scrubber installation. The present standard essentially requires installation of scrubbers -- even when use of low-sulfur coal alone would meet applicable emission standards.

Atlantic Richfield Company believes the percent reduction standard needlessly restricts options for pollution control and should be replaced by a single SO_2 emission standard on a per BTU basis. Economic common sense, however, indicates that when scrubbers are required, utilities should be able to recover the capital cost of installation as expeditiously as possible.

With such reforms, the net amount of SO_2 emissions could be reduced in an economically efficient manner, utilizing a plentiful domestic energy resource at relatively lowest cost.

The NSPS process entails an additional problem. Unlike virtually all other regulations, new source performance standards do not become effective on the day they are adopted, but retroactively on the date of their proposal. Since it is not unusual for such standards to take a year or more to be made final, planners have no way of knowing what standard a new or modified project will have to meet. Project and permit approvals are delayed, not for environmental reasons, but for bureaucratic convenience. Simple fairness requires that a regulated party know what standard must be met; rules should be consistent. NSPS, like other regulations, should be effective upon adoption, not before.

Lastly, where plants in need of modernization require substantial expenditures, the present NSPS provisions apply, irrespective of the emission rate upon project completion. Rather than focussing on the emissions the facility will produce, the criterion for NSPS applicability is essentially whether or not more than 50 percent of the replacement cost of new depreciable assets is invested in plant reconstruction. This provision tends to discourage modernization of some older facilities that might otherwise take place. To the extent that this approach needlessly inhibits plant turnover, it is poor public policy. Instead, we suggest that where emissions will not increase significantly for a reconstructed source NSPS should not apply.

VI. EMISSION OFFSETS/BUBBLE POLICY

Atlantic Richfield believes a valuable mechanism for improving the efficiency of Clean Air Act enforcement has already been established. Its effective use, however, needs to be encouraged by Congress. Known as "the bubble concept," the technique controls air quality through identifiable reductions in emissions within a localized area. By treating an entire plant as the emissions "source," the bubble policy allows a plant manager the freedom to tailor his emission control efforts to achieve required emission limits through the most cost-effective mix of controls. These techniques are simple and efficient, and can result in rapid and substantial reduction in the time and cost needed to bring on line new pollution-control-efficient facilities and modifications to existing facilities.

Unfortunately, however, EPA has not utilized these techniques to their fullest and most efficient extent. For example, until recently, the agency has interpreted the D.C. Circuit's ruling in Alabama Power v. Costle as requiring that any significant net increase in emissions by a major existing source be subject to all the requirements of the Act dealing with non-attainment areas, as opposed to only those increases greater than the 100-ton minimum specified for a new source to be subject to the non-attainment provisions. This approach unfairly discriminates against modifications of existing sources and needlessly delays important projects having negligible effects on air quality. For example, under current law a new source emitting less than 100 tons per year is not subject to the non-attainment provisions off the Act. Until recently, however, EPA has required complex modeling demonstrations and other elements of non-attainment analysis where an existing source wishes to modify its operations no matter how small an emissions increase is involved. Such inequity has needlessly discouraged upgrading of existing facilities. Atlantic Richfield recommends that only modifications to a source increasing net emissions by 100 tons per year or more should be subject to non-attainment requirements.

Furthermore, facility-wide definition of source, proposed by EPA to extend to non-attainment areas as well, should be given Congressional concurrence. As previously interpreted by EPA, "source" in non-attainment areas was almost always equipment specific, and, as such, virtually nullified the effective application of the bubble concept in non-attainment areas.

Offsetting emission control can also be used more effectively in areas where a SIP has been approved, but where enforceable regulations implementing it are not yet finally approved. EPA's current policy prohibits use of emission offsetting techniques in such situations, even though a year or more may be needed for enforceable regulations to be promulgated. Thus, during the intervening period, emission reductions are not achieved in the most rapid and cost-efficient manner. In fact, the regulatory process actually discourages cost-effective emission control by failing to give credit for all emission reductions actually achieved. To remedy this, Atlantic Richfield recommends that use of emission offsetting techniques be allowed where states have an appproved SIP in place.

One final administrative simplification would assist in additional effective emission reductions -- namely, simplification of the offset approval process with respect to existing sources. Currently EPA requires that each use of emission offset for existing sources under the "bubble" policy be approved and signed by the Governor of the state and submitted to EPA for possible veto. This creates a needless burden for the state administrative process and slows progress in emission reductions. There is no need for the chief executive of a state to review personally the merits of each emission reduction plan under the "bubble" policy, since the relevant state air pollution control agency has already done so. To speed emission control and reduce administrative complexity, we recommend that for each use of the "bubble," a source should be required to submit a detailed plan for its emission reductions, and the means by which they are to be achieved, to the appropriate regional EPA or state office which should be authorized to give complete approval to the plan.

VII. REGULATION OF ATMOSPHERIC EMISSIONS FROM MARINE VESSELS

The Clean Air Act and its subsequent amendments recognize the differences between stationary and mobile source emissions and specifically account for these differences in the case of aircraft. Title II Part B of the Act gives jurisdiction to the federal government in the regulating of aircraft and specifically prohibits states or local authorities from developing regulations inconsistent with those developed at the federal level. But marine vessels, which are clearly a mobile source and similar to aircraft in the international nature of their trade, are not specifically addressed by Title II. This exclusion of marine vessels has created uncertainty among the States, local authorities, and the Federal EPA as to who has the authority for the control of vessel stack and vent emissions.

This uncertainty over authority poses the threat of unilateral regulation of vessel emissions by various states and local authorities which will lead to the non-uniform treatment of vessels calling at United States ports. Should this uncertainty continue, disruptive regulatory mechanisms would be created and serious restrictions would be placed on national and international commerce.

Furthermore, the feasibility of safely complying with regulations developed unilaterally by States and local authorities is a major concern in view of the characteristics of vessel operations. Safe transportation of cargo, including crude oil or petroleum products, can only be ensured by rigid adherence to carefully developed design specifications, and equipment and operating procedures. This in turn requires a cooperative effort among the maritime industry, the Inter-Governmental Maritime Consultative Organization (IMCO) an agency of the United Nations and the United States Coast Guard (USCG) which is responsible for safe operation of vessels in U.S. waters. This cooperative effort is essential to ensure that vessel equipment and operating procedures are compatible on a national and international basis.

In view of the foregoing, it is apparent that further Federal legislation is required to clarify the respective responsibilities of the States, local authorities, EPA, and the USCG. Therefore, Atlantic Richfield recommends Title II of the Clean Air Act be amended to require the following:

(1) Demonstration of the need for marine emission controls and the safe application of these controls prior to the development of regulations. Studies should be conducted to determine the extent to which vessel emissions affect air quality and the cost effectiveness of controlling vessel emissions relative to controlling similar emissions from other sources. In addition, these studies should address the technological feasibility of safely controlling emissions, specifically the unresolved safety issues which exist in the application of hydrocarbon vapor control technology to marine operations.

(2) Restriction of the regulations, if demonstrated to be necessary, to the federal level and within any limitations required for consistency with the Inter-Governmental Maritime Consultative Organization (IMCO), an agency of the United Nations.

(3) DOT (USCG) approval of operational practices and equipment required to comply with regulations.

(4) Federal preemption of state and local regulations governing marine emissions.

VIII. NON ATTAINMENT AREAS

The present Act forbids construction of new or modified major stationary sources in any area not meeting ambient standards where a SIP has not been approved or is not being implemented. The construction ban applies even though stationary sources may not be the reason that ambient standards have not been met.

In California, for example, the SIP remains unapproved, not because of inadequate controls on stationary sources, but because of problems in adopting inspection and maintenance programs for cars and trucks. The controls for stationary sources are well-established and will not be altered by any automotive program.

Atlantic Richfield recommends that any limitation on construction should not apply where the reason for non-attainment is predominantly unrelated to stationary sources. Certainly, in all cases, proposed sources should be allowed to use offsets to reduce emissions to the degree feasible. In essence, the "bubble" now applied in attainment (PSD) areas for new sources should be encouraged in non-attainment areas as well, as EPA has recently proposed.

The offset concept, however, is of use only in the short-term. As the new-source level of control (or more stringent levels) becomes the norm, by definition available opportunities for offsetting emission reductions will disappear. In the interim, however, there are considerable advantages to allowing these opportunities to be identified and used easily. One means of accomplishing this would be to create a definable "offset commodity" that could be traded freely among firms within an air quality control region. Congressional mandate is required to assure the stability required for such an approach to be effective in practice.

Moreover, where the ambient standard involved governs a pollutant, such as ozone, which is formed in the atmosphere from two or more constituent pollutants that are emitted directly by sources, appropriate tradeoffs between or among such constituent pollutants should be allowed so long as total pollutant produced in the atmosphere is not increased.

Lastly, the short-term ambient standards, as presently implemented, treat as "violations" events that may occur primarily as a result of naturally occurring phenomena, such as unusual weather patterns. Such events, which occur rarely and are beyond human control should not be treated as "violations." The present system specifies how many times a particular pollutant concentration may be exceeded. One alternate and preferable approach would be to specify a percentage of the year when air quality levels specified by short-term standards could not be exceeded. The percentage would be based upon known relationships between frequency of air quality levels and the observed time over which they occur. The subtle but vital difference between the two approaches is that rather than having to predict unlikely occurrences (a difficult mathematical task yielding inaccurate results), the percentage method relies on well-established mathematical relationships that would substantially improve the accuracy and effectiveness of the regulatory process.

IX. HAZARDOUS AIR POLLUTANTS

The program for regulation of hazardous air pollutants under Section 112 of the Act (NESHAP) is perhaps the most stringent control mechanism available to EPA. Accordingly, Congress directed that this program be implemented judiciously in only the most extreme - and limited - situations. When Congress amended Section 112 in 1977 to include authority to apply work practice standards where numerical limitations are impossible, it underscored that every conceivable avenue short of prohibition be attempted before a standard is set which will effectively eliminate certain activities or industry segments.

Section 112 also includes certain limitations of both a substantive and a procedural nature on the Administrator's actions. Such limitations are also included in the judicial review provisions of Section 307. Collectively these "checks and balances," appropriate in view of the powers conferred on the Administrator in Section 112, appear intended to preclude abuse of those powers.

Atlantic Richfield believes that any suggestions to relax or short-circuit the substantive or procedural limitations on its use contained in Section 112 should be rejected. Particularly Congress should turn aside any attempts to specify a list of substances and/or timetables for regulation in the Act. Each of the key steps in the present Section 112 process must be addressed with the best, thorough scientific inquiry -- the sort of inquiry that cannot occur during the political give and take of the legislative process.

If Section 112 is opened for amendments, there are some improvements, however, that can be made in the Section 112 process. Particularly, all would benefit by clarification that regulation should involve only those sources that are clearly creating hazardous pollution which can be controlled effectively through the NESHAP program.

Atlantic Richfield does not believe that any legislative changes to Section 112 are required at this time. Administrative changes can handle current concerns. If Section 112 is opened for amendment, however, Atlantic Richfield recommends the following statutory changes to Section 112:

(1) Prior to listing and regulating under Section 112, evidence as to the hazardous nature of an air pollutant and its sources should be obtained and evaluated in a thorough scientific manner according to uniform study criteria including peer review and on the record analysis of the relative value of the evidence. These criteria should include quantitative risk assessment and limit evidence to that relevant to the airborne exposure route.

(2) The listing provisions should be changed to acknowledge the Administrator's authority to list a hazardous substance as to only certain source categories that are responsible for the hazardous pollution.

(3) The Administrator's power to remove a substance from the NESHAP list as to some or all source categories on the basis of a determination not to regulate or on the basis of newly obtained evidence should be clarified.

(4) It should be clarified that the listing action constitutes final agency action subject to judicial review. This should eliminate the need to reconsider the agency's listing record each time regulation of a source category is reviewed.

(5) The Act should clarify that standard-setting priorities among source categories of a listed pollutant and among listed pollutants should be established on a cost-effective basis.

(6) The opportunity for full public participation and submission of relevant evidence during the pre-listing review process should be affirmatively recognized in the statute.

(7) The currently proposed differentiation between new and existing sources when promulgating emission standards should be included in the Act.

(8) The artificial and unrealistic requirement that the Administrator must promulgate emission standards within one year of listing a hazardous air pollutant should be eliminated.

X. REGULATION OF FUELS

The provisions of Section 211 authorize the Administrator to regulate fuels and fuel additives. Upon March 31, 1977, it became unlawful for any manufacturer of any fuel or fuel additive to introduce into commerce or increase the concentration of such fuel or additive in general use in light duty motor vehicles unless it is substantially similar to fuels or fuel additives used in certification of 1975 or later model year vehicles under the motor vehicle compliance certification program of Section 206 of the Act or has been waived. Fuels and fuel additives not meeting these requirements had to be phased out by September, 1978.

Unfortunately, Section 211 does not define the term "substantially similar," and the interpretation recognized by the Administrator to-date is not sufficiently broad to allow the practical implementation of modern motor vehicle fuels technology. The restricted availability and increased price of crude oil, together with the increased demand for unleaded gasoline, especially premium unleaded, has made it cost effective and environmentally desirable to take advantage of the volume-extending and octane-enhancing properties of many common alcohols and ethers used as gasoline blending components. These include, gasoline grade tertiary butyl alcohol (GTBA), methyl tertiary butyl ether (MTBE), Methanol/GTBA in combination and ethanol.

To date, introduction of such fuels has been accomplished through use of the waiver procedure provided by Section 211(f)(4). Under this provision the Administrator may "waive" the prohibitions of the section on a case-by-case basis if the waiver applicant establishes that "such fuel for fuel additive or a specified concentration thereof":

> ... will not cause or contribute to a failure of any emission control device or system (over the useful life of any vehicle in which such device or system is used) to achieve compliance by the vehicle with the emission standards with respect to which it has been certified pursuant to Section 206.

The case-by-case "waiver" provision does allow authorization of specific fuels or fuel additives so long as the emission control devices would continue operating over the useful life of the vehicle so as to keep the vehicle in compliance with emissions limitations. The "substantially similar" provision of Section 211(f), however, was intended to allow the vast majority of fuels or fuel additives to be introduced on a generic basis. It is our belief the Act should be amended to facilitate introduction into commerce of new fuels blending component and fuel additives, which can be readily shown to be compatible with emission limitations requirements of the existing automotive fleet.

Fuels and additives meeting generic criteria would not be as precisely limited as to properties of constituent materials and concentrations as the case-by-case waived fuels and additives. Most importantly, the establishment and continued revision of a generic finished fuel definition, which covers "substantially similar" fuels (including blending components) and fuel additives and satisfies the statutory standard, would permit, on the basis of advancing technology, the rapid and less costly introduction of useful materials without sacrificing compliance with emission limitations. EPA could assemble and expand the necessary data to demonstrate that fuels or fuel additives, which meet particular substantially similar finished fuel parameters and limits, will not cause the violation of an emission standard without requiring expensive and time-consuming documentation for each material or variation in quantity or proportion.

In order to have effective enforcement and self-policing of such a fuel and fuel additive registration system, it is imperative that standardized analytical monitoring procedures and tests including repeatability and reproducibility limits be established. This is true both as to whether a proposed fuel or fuel additive meets the generic finished fuel substantially similar definition and thus does not require a waiver and as to whether a fuel or fuel additive in the marketplace meets the applicable criteria be they generic or set forth in a specific waiver. EPA has not provided such standardized analytical monitoring procedures and tests.

To correct this situation, Atlantic Richfield Company recommends inserting the following language at the end of subsection (f)(1) of Section 211:

> A fuel or fuel additive shall be deemed to be substantially similar if it or a specified concentration thereof (as measured by finished fuel parameters and limits), and the emission products of such fuel or additive or specified concentration thereof, will not cause or contribute to a failure of any emission control device or system (over the useful life of any vehicle in which such device or system is used) to achieve compliance by the vehicle with the emission standards with respect to which it has been certified under section 206. The Administrator shall establish and periodically review the broadest possible generic definition of substantially similar fuels and fuel additives provided the finished fuel parameters and limits in either the waiver or the substantially similar definition, whichever is greater, are maintained. In establishing a generic definition of "substantially similar," the Administration shall include standardized analytical monitoring procedures for the particular parameters and limits which are set.

And inserting the following language at the end of subsection (f)(4):

> In granting a waiver application the Administrator shall establish standardized analytical monitoring procedures which apply to the parameters and limits which have been set unless an applicable monitoring procedure has previously been established under subsection (f)(1).

CONCLUSION

The reforms offered above do not represent fundamental changes in the Clean Air Act. They preserve the health-based protection afforded by current statutes, and they would, if adopted, go some way toward reconciling aesthetic and economic aspects of protection of human and environmental welfare. Most emphatically, they require substantive environmental protection.

It is also true, however, that the reforms suggested do not represent a thoroughgoing rethinking of the principal assumptions of the Clean Air Act. Such critical analysis may become necessary, however, as attainment deadlines and realities of noncompliance bear hard upon the major developed areas of the Nation.

Atlantic Richfield does believe that the reforms we suggest for the Act's 1981 reauthorization would result in an improved climate for overall analysis to take place with positive results. Specifically:

(1) Institution of an independent scientific review process would facilitate accurate assessment of the health-protection assumptions of the Act and their possible improvement.

(2) The several reforms in the interest of facilitating reasonable pollution-control-efficient economic development, and energy and mineral development in particular (while preserving aesthetic considerations for areas of national unique scenic beauty), could ameliorate the "adversary culture" of the Act.

(3) In concert, peer review and accommodation of national priorities could facilitate a climate for needed information exchange among the legal, scientific, economic and political professions, which to date has not been effective and without which responsible long-term management of pollution-producing technology can not occur.

Atlantic Richfield realizes that deliberations over reauthorization of the Clean Air Act are likely to be charged with controversy. We welcome the opportunity to discuss the position articulated above in whatever public, legislative, or environmentally-oriented forums are appropriate.

RNS: 4/13/81
Govt'l Issues/Gov't Rel.

ORAL STATEMENT BY SHELL OIL CO., FAIRBANKS, ALASKA, JULY 1, 1981

STATEMENT

My name is Donald E. Glass. I am employed by Shell Oil Company in Anchorage where I am the Manager, Coastal Environmental Activities. My testimony today is being presented on behalf of Shell.

Both my company and I are grateful to you, Senator Murkowski, and to the Senate Committee, for providing this opportunity to submit Shell's views on needed changes to the Clean Air Act, especially as reflected by Shell's experiences with the Act's implementation in Alaska and its offshore waters.

The Clean Air Act and, more particularly, its 1977 Amendments, has had both direct and indirect detrimental effects on Shell's Alaskan exploration and production activities. The direct effects stem from the Act's provisions for the prevention of significant deterioration of air quality. The indirect effects arise from analogous PSD provisions contained in the Outer Continental Shelf Lands Act.(1) Unless the PSD provisions of the Clean Air Act are changed, and the OCS Lands Act is reinterpreted, one must expect the type of effects I now shall describe will become more frequent and more acute as the tempo of oil and gas development increases in the Alaska area.

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(1) Air Control Regulations (30 CFR Part 250.57 at 45 Fed. Reg. 15147) Mandated by the Outer Continental Shelf (OCS) Lands Act Amendments of 1978 (PL 95-372)

The OCS Lands Act mandates control of air emissions from offshore activities. USGS and EPA have used this mandate to impose emission limitations on all offshore petroleum extraction industry operations. The USGS air regulations are patterned after the Clean Air Act regulations. They include emissions impact analysis, Best Available Control Technology (BACT), and post installation emission monitoring. These terms are taken from the Air Act's PSD requirements.

Currently, Shell Oil Company is preparing an application to drill an exploratory well on a gravel island in the Beaufort Sea. The location will be about 18 miles east of Prudhoe Bay and 5.1 miles from land. For this activity, we must satisfy the emissions impact analysis provisions of the air regulations. The US Geological Survey provides two methods to satisfy the analysis provision. First, an exemption is provided in the form of a formula which connects the maximum allowable exemption in tons/year with the distance between the source and the shoreline. Failing this exemption test, overwater modeling is required.

The initially proposed formula[2] for exemption was submitted by industry. It was based on "worst case" meteorological data found in East Coast, Gulf Coast, West Coast and Alaska OCS areas. Additionally, the models used by industry

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(2) $E = 80 D$

where E = exempted emission rate, ton/year

D = distance, miles from shoreline

were EPA approved models which incorporate a safety factor conservatively estimated to be about 250 percent. The U.S. Geological Survey with advice from the Environmental Protection Agency, rejected the industry proposal in favor of a similar, more severe formula.[3] The agency's formula exempts a 100 tons/year source at 3 miles from shore. Interestingly, this is identical to the Air Act's definition for an onshore major stationary source located in a nonattainment area. The USGS did not justify its exemption formula when the OCS air regulations were promulgated. It appears that the USGS manipulated its formula to force an emissions source lying 3 miles offshore to meet the same emission limitations as required by the EPA for a source in the center of a nonattainment area.

The result is that Shell will be ineligible for the exemption at the afore-mentioned offshore well, because the estimated emissions exceed the exemption threshold.[4] Consequently, Shell now must perform site specific overwater modeling which is both time consuming and costly. Had the USGS used the industry-proposed formula, which we believe to be realistic and appropriate, the well would have been exempted from the emission impact analysis.

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(3) E = 33.3 D.

(4) Threshold:
According to USGS formula: 170 tons/yr.
According to Industry-proposed formula: 408 tons/yr.
Estimated emissions from Shell project: 205 tons/yr.

Modeling requires site specific meteorological data. Offshore data of sufficient detail to satisfy the modeling requirements are not presently available so onshore data must be extrapolated to offshore situations. This extrapolation tends to indicate a worse emissions effect than if actual offshore data were used. Thus Shell will be penalized because of the lack of suitable data and because of the time necessary to perform the modeling. Experience shows at least 150 days are required to secure a modeling contractor, gather the data, perform the modeling, prepare the result in the detail required under the CAA and submit the report. With the already abbreviated drilling season in effect on this well, this effort could set back exploratory drilling as much as an entire year.

Other delays and costs will stem from the need for Shell and the regulatory agency to agree upon what controls satisfy the BACT requirement, and to implement an emissions monitoring program.

As a result of Shell's experiences with the Clean Air Act as it has been implemented in Alaska we believe that Congress should reexamine the Act's statutory PSD program and the corollary OCS requirements. Such reexamination might legitimately focus on whether the clean air benefits originally anticipated by Congress to flow from the PSD program are real or are an illusion, and whether or not the delays and incrementally higher costs which inhibit Alaskan OCS oil and gas development are an acceptable price to pay. For onshore purposes, Shell believes that a combination of BACT and protection of national secondary standards is a simpler alternative to PSD and one which would afford adequate protection to air quality over both Alaska and the "lower 48." For offshore purposes, Shell believes that, as the distance from a shoreline increases, the stringency of emission controls legitimately can be decreased without adverse effects onshore.

In a larger sense, and based upon our experiences in the lower 48 states, Shell has made a dedicated and consciencious effort to examine ways by which the present Clean Air Act might be revised to make it more workable without jeopardizing its laudable environmental goals. The result of Shell's effort is summarized in the attachment to our statement being submitted for the record. In summary, Shell believes that the Clean Air Act should be changed in the following ways :

- The Clean Air Act Should include explicit requirements that national primary ambient air quality standards be set at levels which are free of unreasonable risk to public health.
- Economic factors and social consequences should be included among the factors to be considered by the EPA in setting or revising national ambient air quality standards.

- The EPA should be required to consider all scientific data relevant to a given topic and all such information should be subjected to a searching peer review process.

- All specific deadlines and target dates should be removed from the Act. In their place, the EPA should be granted discretion to pursue the targets at the earliest practicable date, taking into account technical and economic feasibility.

- The brute force concept embodied in the present Clean Air Act should be modified to accommodate innovative strategies, such as economic incentives and disincentives, which allow flexibility in complying with regulations.

- The causes, effects, scope and magnitude of the so called "acid rain problem" should be investigated and understood before regulations are promulgated.

- All segments of the nation's economy and society should share in the costs of attaining the NAAQS's in some proportion to their respective contributions to air pollution.

- The statutory requirement for certain nonattainment areas to impose auto inspection and maintenance (I/M) programs should be revoked or, alternatively, if the only reason for imposing the ban is a state's failure to have an I/M program, the statutory ban on construction of stationary sources should be revoked.

This concludes my prepared testimony. If you have any questions, I will be pleased to try to respond to them. Thank you.

NEEDED CHANGES IN THE CLEAN AIR ACT: THE VIEWS OF SHELL OIL COMPANY

INTRODUCTION

Federal legislation in the field of air pollution control can be traced back for more than 25 years. President Eisenhower, in 1955, recommended that Congress enact legislation dealing with air pollution and Congress complied. This law was signed in July of 1955. President Kennedy continued throughout 1962 to request new legislation at the federal level concerned with air pollution, but it is probable that a major air pollution disaster in London in 1962 exerted a greater impact on Congressional thinking than did executive requests. Nevertheless, a bill was passed in 1963. It was signed by President Johnson in December of that year and it was called the Clean Air Act of 1963. This basic law was amended in 1965 and again in 1967. Each amendment moved the federal government toward a position of dominance regarding air pollution control.

The next major legislative event in the air pollution control field consisted of the Clean Air Act Amendments of 1970. This particular set of Amendments represents a discontinuity in the evolution of federal air pollution control legislation. Circumstances leading to this significant law deserve comment. In particular, both the public and Congress were disturbed by the pace of air quality improvement. Despite a great deal of legislation beginning in 1955, the nation's air was not exhibiting major improvements in quality. Public concern in some instances was growing dramatically. The 1970 Clean Air Amendments therefore mandated specific targets to be attained in accord with definite timetables. With the 1970 Amendments, the accretion of power at the federal level was virtually complete. This law required that EPA establish national primary and secondary air quality standards for certain pollutants. Although standard setting continued to move to the federal level as a result of the 1970 Amendments, major responsibilities for enforcement of the law rested at the state and local levels but under close supervision by the EPA.

The strict 1970 Clean Air Amendments were augmented with additional stringent requirements in the 1977 Clean Air Act Amendments.

1970 and 1977 AMENDMENTS: WHAT WENT WRONG?

From the title of this paragraph an unwary reader might infer that the Clean Air Amendments of 1970 and 1977 proved to be failures. It is not the purpose of this paragraph to convey that impression. The 1970 Amendments, by design, represent a pioneering piece of legislation which embodies a discontinuity - a substantial departure from the previous evolution of federal laws concerned with air pollution abatement. Since the 1970 Amendments were intended to require significant divergences from earlier approaches, it is a credit to its draftsmen that the experiences since then generally demonstrate that the Act was successful and usually workable. The 1970 and 1977 Amendments have produced changes and significant progress has been made toward achieving improved atmospheric quality in many parts of the nation. Despite the successes of the 1970 and 1977 Amendments, they're not perfect. Some of their provisions have not withstood the tests of practicality and cost-effectiveness. The following paragraphs explore the reasons for these imperfections and suggest ways for improving the 1970 and 1977 Clean Air Act Amendments.

Some representatives of some segments of our society allege that industry seeks to "gut" the Clean Air Act. Other segments of society assert that more modest changes are needed to make the Act more workable; Shell agrees. We have had more than 10 years of experience working under the 1970 Clean Air Amendments In that time we have learned a great deal about the sources, atmospheric chemistry, fate and effects of atmospheric pollutants. We've also come to appreciate that air pollution is not the nation's only major problem and that all the nation's problems can not be resolved simultaneously. We have come to appreciate the fact that our resources, although large, are finite. Therefore it is essential that we prioritize our nation's needs, and attack our problems in a rational and orderly procedure. Only in this way can society achieve the optimum benefits from the commitment of its resources. It is not Shell's intent to politicize or polarize discussions which are likely to ensue concerning the Clean Air Act Amendments. We seek to avoid emotionalism on this topic and to approach it with a rational set of recommendations for achieving our goals in the most efficient and effective manner.

Shell's positions and recommendations with regard to needed changes in the Clean Air Act are included in the paragraphs which follow.

THE DEGREE OF HEALTH PROTECTION REQUIRED

Among the stated purposes of the Act is "...to protect and enhance the quality of the nation's air resources so as to promote the public health and welfare and the productive capacity of its population". A specific mandate from Congress in the 1970 Amendments is the requirement that EPA promulgate national ambient air quality standards "...the attainment and maintenance of which in the judgment of the administrator, allowing an adequate margin of safety, is requisite to protect public health". "Public health" is nowhere defined, nor is "adequate margin of safety". Hence, EPA wrote its own definitions and in their interpretation, it is their mandate to protect all of the people all of the time from all airborne health threats. Furthermore, the EPA views it as their duty to ensure that no present exposure to any airborne pollutant shall leave any individual more susceptible to any disease at any future time.

This is a zero risk approach and because it is zero risk, it is impossible to attain. Advances in analytical procedures and in epidemiology make it certain that somewhere someone will be found who is affected by levels of airborne materials previously thought to be without effect. Hence, society is faced with changing targets which remain unattainable. Perhaps no one summarized it better than did William Ruckelshaus soon after leaving his post as EPA Administrator. He had this to say: "We have made a mistake in setting for ourselves goals that are essentially unachievable. If we took every dollar in the nation and every technological capacity we have and devoted it solely to the protection of air, we still would not achieve that goal". Shell believes that Congress should define precisely what its intent was in 1970. Such an expression would make it unnecessary for EPA to develop unilateral interpretations of Congressional language and intent.

In addition, EPA's implementation procedures for developing to the national ambient air quality standards are flawed. In developing the criteria documents which serve as the foundation for national ambient air quality standards, the agency has been content with a non-critical literature review. This practice involves collecting all published literature on a given topic and accepting all of it at face value without attempting to evaluate the reliability, the age, or the source of the document. Under this procedure, national ambient air quality standards invariably emerge as worst case limits. In addition, the EPA confuses "measurable effect" with "adverse effect". In several instances low airborne concentrations of a given material can produce measurable effects in some physiologic parameter. The agency assumes that any measurable effect is adverse.

Shell recommends therefore, that the words of the Clean Air Act include explicit requirements that national ambient air quality standards be set at levels which are free of unreasonable risk to public health.

ECONOMIC FACTORS AND SOCIAL CONSEQUENCES

The legislative history of the Clean Air Amendments of 1970 indicates clearly that Congress intended for EPA to ignore economic factors during the agency's process of setting national ambient air quality standards. In essence, Congress said let there be clean air by date certain regardless of the cost.

Shell believes that economic factors and social consequences are factors which must be considered during the national ambient air quality standard setting process. We believe that the Amendments to the Clean Air Act should explicitly require EPA to consider them.

PREVENTION OF SIGNIFICANT DETERIORATION (PSD) REGULATIONS

The PSD concept had its origin in 1972 litigation and was incorporated by Congress in the 1977 Clean Air Act Amendments. It is Shell's opinion that the PSD program is the most intractable element in the Clean Air Act and its Amendments. We believe that several flaws exist in the PSD process as it is now. The PSD process places considerable weight on atmospheric modeling, an inexact science which is especially tenuous when applied to irregular terrain or reactive pollutants. Secondly, the permitting process is long and costly. Changes in the regulations since 1977 have added months to the approval process. Preconstruction monitoring, where required, adds additional time. Further, Best Available Control Technology (BACT) determinations are reached without a uniform or predictable procedure. Furthermore, an applicant for a PSD permit receives no early guidance about what portion of the increment may be granted. Finally, despite the costs, the uncertainties, and the delays imposed by the PSD process, there is little evidence to suggest that air quality will be protected better than by BACT only.

Shell recommends therefore, that the PSD requirements be limited to Class I areas only. For Class II and Class III areas, BACT should be applied subject to the existing air quality standards.

These three changes suggested above represent those changes of highest priority in Shell's viewpoint. There are other changes which Shell believes would be beneficial in the Clean Air Act Amendments. These are of lower priority and are discussed in the paragraphs which follow.

VALIDITY AND REVIEW OF THE EVIDENCE

Under current practice, EPA can (and does) set standards and promulgate regulations on the basis of scanty or unreliable data. Court challenges of regulations promulgated in this fashion have been generally unsuccessful because judges are reluctant to substitute their judgment for that of the administrator on matters involving scientific or technological questions. Shell believes that regulations should be based on sound scientific evidence which has been subjected to a searching peer review.

Shell recommends therefore, that language be inserted in the Clean Air Act which explicitly requires the EPA to consider all scientific data relevant to a given topic. Furthermore, EPA should be required to subject all reports which serve as a foundation for agency acts to be subjected to a searching peer review process. This process should evaluate the significance, the validity, and the completeness of the evidence, both individually and collectively.

SCHEDULES AND TIMETABLES

Starting with the 1970 Clean Air Act Amendments, and again in 1977, Congress wrote enactments containing many specific deadlines. These deadlines were included partly because of emotional responses by Congress. This attitude should be reversed. The EPA and the states should receive explicit discretionary authority to achieve the required tasks as expeditiously as possible, but in a scientifically, technologically, and economically efficient manner.

Shell recommends therefore, that all specific deadlines and target dates be removed from the Act. In their place, the EPA administrator should be granted discretion to pursue the targets at the earliest practicable date, taking into account technical and economic feasibility.

ECONOMIC INCENTIVES AND DISINCENTIVES

This topic concerns "non-attainment" areas, i.e., those regions of the nation which fail to comply with one or more national ambient air quality standards. Basic to this topic is the question of how EPA can best apply the air management approach while at the same time permitting reasonable industrial expansion for such societal goals as alternate or expanded energy facilities.

In carrying out the mandates of the 1970 Clean Air Act Amendments, EPA employed a command-and-control approach which attempted to apply a rollback-derived numerical emissions targets on a source-by-source basis. This is a brute-force approach which produced some successes and some improvements in air quality. However, by the mid-1970's the flaws in this approach had become obvious. Command and control is too costly; command and control does not foster innovation and new technology; and finally industrial growth was threatened.

The 1977 Amendments contained the first recognition by Congress that compliance costs were part of the equation. Regulatory overload was beginning to be recognized and EPA, accordingly, began tentative exploration of economic factors such as offsets and bubbles. Offsets have produced some progress and the first bubbles now are being approved more than a year after the policy was published. A new concept, marketable emissions credit, is being developed slowly.

We believe that innovative strategies must be devised and perfected to allow flexible application of economic factors when regulations are promulgated by EPA. The objectives of these reforms must be to allow business management to make cost-minimizing decisions within the framework of the existing Clean Air Act goals.

ACIDIC PRECIPITATION

The phenomenon of acidic precipitation, sometimes called acid rain, is attracting increased attention. It is postulated that man-made sulfur oxides and nitrogen oxides are converted in the atmosphere to sulfuric and nitric acids which ultimately fall to earth, often in association with rain or snow. In recent years this phenomenon has been examined widely, especially in the Scandinavian countries. Less study has been conducted in this nation. There are still uncertainties as to the causes and effects of acidic precipitation.

Shell recommends therefore, that the causes and effects of acidic precipitation be understood thoroughly before regulations are promulgated. Otherwise, society may be compelled to spend large sums of money futilely We need to know fully the causes and effects of acidic precipitation before regulations are promulgated and Shell urges that efforts to develop this understanding be given a high priority.

TRANSPORTATION CONTROLS AND INDIRECT SOURCE CONTROL

This topic concerns the equity with which air-management strategies are implemented by EPA. Shell believes that regulations should be promulgated in an even-handed manner that requires all segments of the nation's economy and society to share the costs of attaining NAAQS's in proportion to their respective contributions to air pollution. In particular, for areas which remain non-attainment with respect to carbon monoxide, ozone, and nitrogen oxides, Shell believes that transportation control measures are appropriate and that indirect source controls might be appropriate. (Transportation control measures include such concepts as improved mass transit and car-pool incentives; indirect source controls involve parking limitations, shopping center design, and urban planning.)

Shell believes, however, that EPA should be prohibited from banning construction in those areas which fail to comply with statutory decrees to institute vehicle inspection-and-maintenance (I/M) programs. Shell believes that I/M, as currently practiced, is inequitable and not cost-effective.